

MARINE SHRIMP FARMING AND AQUACULTURE RESEARCH

Y 4. AP 6/2: S. HRG. 104-476

Marine Shrimp Farming and Aquacultu...

HEARING

BEFORE A

SUBCOMMITTEE OF THE
COMMITTEE ON APPROPRIATIONS
UNITED STATES SENATE
ONE HUNDRED FOURTH CONGRESS

SECOND SESSION

SPECIAL HEARING

Printed for the use of the Committee on Appropriations



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MARINE SHRIMP FARMING AND AQUACULTURE RESEARCH

FRIDAY, FEBRUARY 16, 1996

U.S. SENATE,
SUBCOMMITTEE ON AGRICULTURE, RURAL
DEVELOPMENT, AND RELATED AGENCIES,
COMMITTEE ON APPROPRIATIONS,
Biloxi, MS.

The subcommittee met at 9:30 a.m., in the auditorium of the J.L. Scott Marine Education Center and Aquarium, 115 Beach Boulevard, Biloxi, MS, Hon. Thad Cochran (chairman) presiding.

Present: Senator Cochran.

NONDEPARTMENTAL WITNESSES

PANEL ONE—U.S. MARINE SHRIMP FARMING PROGRAM

OPENING REMARKS OF SENATOR COCHRAN

Senator COCHRAN. The Subcommittee on Agriculture, Rural Development, and Related Agencies is now in order.

I am very pleased to be able to call this meeting to order. I want to welcome everyone who is here. Our witnesses have come to discuss with us information about the research activities that are conducted here on the Mississippi gulf coast, particularly those conducted by the University of Southern Mississippi and Mississippi State University.

I want to thank the University of Southern Mississippi Gulf Coast Research Laboratory for hosting today's hearing. This hearing is being conducted under the auspices of the U.S. Senate Appropriations Committee and is authorized by our chairman, Senator Mark Hatfield.

I am chairman of the subcommittee providing appropriations for the Department of Agriculture—including the Department's agriculture, rural development, natural resources and conservation, nutrition and food assistance programs—and related agencies, such as the Commodity Futures Trading Commission and the Food and Drug Administration. All of these Department and agency activities are funded in a separate appropriations bill that has already been passed by the Congress and signed into law by the President for this fiscal year. We were pleased that early in the session of this Congress, we were able to get passage of that bill to fund this year's activities so there has been no slowdown, no work-stoppage that you have heard about that affected some of the other depart-

ments and agencies of the Federal Government. We are very proud of that.

Today we are going to review the federally supported research activities being done here by these two universities, both of which have facilities on the Mississippi gulf coast. The hearing will examine specifically the importance of Mississippi's marine and aquaculture industries. We will hear about specific partnerships between private industry and government in the conduct of research and hear how that research is applied to assure economic and business success in our State.

We will have two panels of witnesses. We will hear from the first panel that will talk about the U.S. Marine Shrimp Farming Program based here at the Gulf Coast Research Laboratory. This program, incidently, was originated in 1984 with support from the Department of Agriculture to counter the U.S. trade deficit in marine shrimp. This research effort is aimed at the development of high-technology processes, products, and services necessary to enable the U.S. shrimp farming industry to expand and become more competitive.

The second panel will discuss aquaculture research activities being conducted at Mississippi State University's Coastal Research and Extension Center. This research involves inquiries in the areas of environmental awareness, fisheries technology, and aquaculture.

I want to welcome all of you here and express my appreciation to you for being here and cooperating with our efforts to more fully understand the importance of these research activities.

I want to specifically welcome Dr. Karen Yarbrough, who is vice president for research and planning for the University of Southern Mississippi, to make the welcoming remarks and share whatever comments she would like to make, and then we will introduce our first panel.

Dr. Yarbrough.

STATEMENT OF DR. KAREN YARBROUGH, VICE PRESIDENT FOR RESEARCH AND PLANNING, UNIVERSITY OF SOUTHERN MISSISSIPPI

Dr. YARBROUGH. Thank you Senator. We want to welcome you, the subcommittee staff and our distinguished guests on behalf of the University of Southern Mississippi, to the Gulf Coast Research Laboratory and the J.L. Scott Marine Education Center and Aquarium. We appreciate greatly your efforts to bring this hearing to our campus, and we welcome the opportunity to show you first hand that part of our research program that is focused on the farming of marine shrimp and related marine aquaculture activities.

Marine aquaculture has long been one of the strongest research areas at the Gulf Coast Research Laboratory, and the research scientists here have contributed greatly to the university's graduate and undergraduate programs in marine sciences. The university's marine programming is in an exciting period of transition and growth.

We will present to the Board of Trustees of Institutions of Higher Learning next month a plan to create an Institute of Marine Sciences which we believe will bring together all of our marine interests in a structure which we believe will contribute positively to our efficiency and effectiveness and which will permit us to have

a greater voice in the national and international ocean sciences communities.

Also contributing to our excitement is the opportunity to plan strategically for the long-term growth of our marine science programs and for the positive impact which they have on the coast. The Board of Supervisors of Jackson County, in concert with the Ocean Springs Chamber of Commerce, last month donated some 200 acres of prime waterfront property to the university for expansion of our Ocean Springs campus. While our plans for this property continue to evolve, we hope that it will permit us to develop further our marine science research interests which would, in turn, permit enhancement of the present property for our academic programming.

While we are certainly proud of our past accomplishments in the marine sciences, we believe we are poised to make even greater contributions to the field in the future. Your past and current support of these programs has been of immeasurable assistance to us. For that support we sincerely thank you.

I would like to take just a moment more to comment about our involvement in the U.S. Marine Shrimp Farming Program. First, let me say that we are proud to take the leadership role in the Gulf Coast Research Laboratory Consortium, and we are excited about our continuing interaction with our colleagues at the Oceanic Institute in Hawaii, Tufts University in Massachusetts, the Waddell Mariculture Center in South Carolina, and the University of Arizona. Through these collaborations, the consortium has built a premier scientific team which is developing the technology needed to make this Nation competitive on a worldwide basis with respect to shrimp farming, thereby reducing the nearly \$2 billion annual trade deficit resulting from the import of foreign shrimp into the United States.

The U.S. Marine Shrimp Farming Program is a truly unique program, both in organization and in approach. Its large-scale, collaborative approach to solving the problems associated with this emerging technology has provided a handsome return to date, and we believe future opportunities are very promising.

The program has consistently received the highest marks upon review by the U.S. Department of Agriculture. Indeed, they have suggested that this program should serve as a model for governmental efforts to assist industry development. And, in what is likely the most important testimonial of all, commercial shrimp farming interests in Hawaii, Arizona, Texas, and South Carolina have documented their support for the program in letters to your subcommittee last year.

As we continue in our efforts to lessen our reliance on foreign growers to satisfy our demand for shrimp and other seafood products, the mariculture industry must solve the myriad problems associated with disease outbreaks and environmental impacts, just as those pioneering programs with beef, poultry, swine, and row crops did decades ago. While we have made great strides thus far, there is much yet to be done.

I think that as my colleagues provide their testimony today, you will discover that the rate of progress is rapid and that we will be successful in achieving the goals of the program. Let me once again

assure you and your colleagues in the U.S. Senate that the University of Southern Mississippi will continue to do its part to ensure that the program moves forward.

On behalf of all of my colleagues at the university, let me thank you again for holding this field hearing at our Gulf Coast Research Laboratory's Marine Education Center and for your continued support of this important program.

Senator COCHRAN. Thank you very much, Dr. Yarbrough, for your kind remarks and for the information that you have given us about the consortium and what it is doing to expand our efforts in this area. We have long known of the importance of these industries to our State of Mississippi. I know that there are other States that are represented here and are involved and have a big stake in this outcome as well.

In terms of both jobs and economic benefits, Mississippi ranks No. 1 in the United States in catfish production and has emerged as one of the leading aquaculture producing States in the Nation. We and others are in the position given these resources to capitalize even further with the right kind of technology and information and basic scientific data and facts that this research activity is designed to produce.

PANEL ONE

I am going to turn now to our first panel of witnesses. Dr. Yarbrough, I know, has other requirements for her time today so whatever time you have to leave, please feel free to do that, but we thank you for being here to open our hearing in the way that you have and provide the support for our efforts that you have provided.

Dr. William Walker is the assistant director for research at the University of Southern Mississippi Gulf Coast Research Laboratory here and Mr. Jan Dill is vice president, co-chief executive officer of the Oceanic Institute of Hawaii. I am going to ask Dr. Walker to proceed to introduce the other members of the panel and make whatever comments and testimony you and your panel would like to make. Dr. Walker.

Dr. WALKER. Thank you Senator Cochran. I would like to ask Mr. Jan Dill, co-CEO of the Oceanic Institute to say a few words to us at this point.

STATEMENT OF JAN DILL, CO-CHIEF EXECUTIVE OFFICER, THE OCEANIC INSTITUTE, CENTER FOR APPLIED AQUACULTURE, HAWAII

Mr. DILL. Mr. Chairman, Dr. Yarbrough, thank you for allowing me to say a few words this morning. I'm Jan Dill, vice president, co-chief executive officer of the Oceanic Institute of Hawaii. I also have the privilege of serving as the chair of the executive committee of the Gulf Coast Research Laboratory Consortium.

On behalf of my colleagues on the executive committee and the institutions that we represent, I want to thank you for the support and confidence that you, Mr. Chairman, and your colleagues on the subcommittee have given to the consortium.

In light of the economic consequences of the over \$2 billion annual deficit in shrimp crops, the consortium has endeavored to be diligent and faithful stewards of your support and confidence. Over

the years the consortium has been a recognized model for a directed and practical industry development and research. We hope to share with you today some of the consortium's significant achievements and also to offer you a picture of the horizon of opportunity we see for the United States in the industry worldwide.

Again, on behalf of the consortium and the executive committee, I thank you for your support and confidence. We are pledged to continue to work together with your fine support.

Thank you Mr. Chairman.

Senator COCHRAN. Thank you Mr. Dill. Dr. Walker.

STATEMENT OF DR. WILLIAM W. WALKER, ASSISTANT DIRECTOR FOR RESEARCH, UNIVERSITY OF SOUTHERN MISSISSIPPI, GULF COAST RESEARCH LABORATORY

INTRODUCTION OF ASSOCIATES

Dr. WALKER. At this time I would like to introduce the rest of the members of this first panel that are here today. Seated immediately to Mr. Dill's right is Dr. Paul Sandifer, director of the Marine Resources Division of the Waddell Mariculture Research and Development Center in South Carolina.

The next person on the list is Dr. Gary Pruder, also of the Oceanic Institute. Dr. Pruder is ill today and will not be able to be here in person. His testimony will be read by Dr. Paul Bienfang.

Then there is Dr. Jeff Lotz. He is with the Gulf Coast Research Laboratory. He heads up the U.S. Marine Shrimp Farming Program there. He is an acknowledged expert on disease.

Next is Mr. Jeffrey Peterson who is president of the South Carolina's Shrimp Growing Association and he will give one or two industry prospectives on the value of the consortium.

The next industry person is Mr. Ray Jones. He is the director for quality assurance and regulatory affairs with Rich-SeaPak Corp. in Georgia, one of the United States' major processors of shrimp and seafood.

And then Dr. Paul Bienfang, who is also co-chief executive officer with the Oceanic Institute. Then I will do a short wrap-up at the end.

At this point I will proceed, if I may, with introductory testimony and simply say, thank you again for being here.

To date, over \$30 million have been invested in the U.S. Marine Shrimp Farming Program [USMSFP]. The technologies, products, and services developed during this period have catapulted the United States into a world leadership role in second generation shrimp farming (USDA 1994). It is widely recognized that this effort has been funded by a congressional initiative spearheaded by yourself, this subcommittee, and your colleagues in the Senate and in the House.

The U.S. Marine Shrimp Farming Program was conceived here in Mississippi in discussions between the Gulf Coast Research Laboratory [GCRL] and the Oceanic Institute [OI] in 1983. The Gulf Coast Research Laboratory and the Oceanic Institute formed the Gulf Research Laboratory Consortium, which has executed the program since its inception in 1984. Both the GCRL and OI have program management responsibilities and each receive direct grants

administered by the Cooperative State Research, Education, and Extension Service of the U.S. Department of Agriculture [USDA].

From the beginning, the GSRL consortium recognized the vast potential of this program and was committed to identifying and incorporating the very best scientific expertise available.

As a direct result of that approach, the Consortium expanded to include the scientific talents and facilities of: Tufts University, Massachusetts, Dr. Acacia Warren in the area of quantitative genetics, performance and disease resistance, and gene tags; Waddell Mariculture Laboratory, South Carolina, Dr. Paul Sandifer in the area of environmental protection, intensive growout, and potential alternative species; Texas A&M University, Texas, Dr. Addison Lawrence in the area of shrimp growout, feed formulations, and field disease prevention and treatment; and University of Arizona, Arizona, Dr. Donald Lightner in the area of diagnostics, molecular probes, quarantine, and disease screening and prevention.

Expertise from these cooperators was added to that provided by: University of Southern Mississippi and Gulf Coast Research Laboratory, Mississippi, Drs. Jeffrey Lotz and Robin Overstreet in the area of disease diagnostics, mechanisms of disease, and maintenance of a high health stream of shrimp broodstock and seed for the U.S. industry; and the Oceanic Institute, Mr. James Sweeney in the area of shrimp breeding and genetic selection, maturation and hatchery technologies, and intensive production systems.

The U.S. Marine Shrimp Farming Program targeted a need for the United States to assert itself and become less dependent upon shrimp imports, which had reached an annual deficit of \$2 billion. Payoffs from the program have been reflected in increasing U.S. shrimp production through 1994, everincreasing export of shrimp technologies and stocks, and world recognition of the program and the standard of excellence in science and technology.

While the consortium has accomplished much, its work is not finished. The shrimp domestication program in the United States has successfully cleared only its initial hurdles, and remains today totally dependent on the consortium for its continued development and success. In 1995, exotic viruses found their way to isolated shrimp farms in this country, and this occurrence provided additional incentive for the U.S. Marine Shrimp Farming Program to complete the development of biosecure and environmentally friendly shrimp growout systems. While worldwide shrimp production is being devastated by disease and environmental problems, the United States is becoming competitive, based upon the consortium's ability (1) to produce high-health and genetically improved stocks, (2) to control disease agents, (3) to enhance environmental protection, and (4) to develop animal husbandry methods.

The U.S. Marine Shrimp Farming Program looks forward to a cooperative association with the shrimp processing industry in developing methodologies appropriate to protect both shrimp farming and natural fisheries resources from foreign disease agents.

Finally, the program recently underwent a critical outside review organized and executed by the U.S. Department of Agriculture, in which the areas of organization and management, industry seed supply, disease control and animal health, environmental quality, and shrimp production technology were scrutinized. This review

was particularly favorable and Dr. Sandifer will provide additional detail. This review is included in your packet.

At this time I would like to turn the microphone over to Dr. Sandifer.

Senator COCHRAN. Dr. Sandifer, you may proceed.

STATEMENT OF DR. PAUL A. SANDIFER, DEPUTY DIRECTOR FOR MARINE RESOURCES, SOUTH CAROLINA DEPARTMENT OF NATURAL RESOURCES

Dr. SANDIFER. Good morning Mr. Chairman, and thank you. Dr. Yarbrough. It is a pleasure to be back at the gulf coast. I am Paul Sandifer, deputy director for marine resources of the South Carolina Department of Natural Resources. I am also a member of the Executive Committee of the Gulf Coast Research Laboratory Consortium, which oversees the U.S. Marine Shrimp Farming Program. In addition to my other activities, I also supervise the James M. Waddell, Jr. Mariculture Research and Development Center in South Carolina, which is a participant, as you heard, in this program.

Personally, I also have nearly 25 years experience in aquaculture research, development and extension, and education work in aquaculture. I thank you for the opportunity to appear before you this morning to express South Carolina's strongest support for the continuation and expansion of the U.S. Marine Shrimp Farming Program.

I will attempt to abbreviate my remarks and submit the entire text of my prepared statement for the record.

The Marine Resources Division of the South Carolina Department of Natural Resources, which I direct, is basically a marine fisheries management agency, but in addition, we have a mandate to develop mariculture as a viable enterprise in South Carolina. This mandate is based upon South Carolina's rich history of leadership in the development of marine aquaculture, which began nearly 50 years ago with the work of the late Dr. G. Robert Lunz at the Bears Bluff Laboratories and has continued since 1972 in the Marine Resources Division and since 1984 in the Waddell Center.

This center has become recognized regionally, nationally, and internationally as one of this country's leading aquaculture experiment stations. It is especially well known for its primary work culture of marine shrimp.

Now, I would like to give you a bit more information about South Carolina's marine shrimp farming industry. I will not go into much detail since Mr. Peterson will be presenting the South Carolina viewpoint. However, I would like to give you just a few statistics.

The shrimp trawling industry is by far the most important commercial fishery in South Carolina and has been for many years. In 1995, South Carolina had the highest commercial shrimp landings our agency has recorded since we began keeping detailed catch statistics in 1972. This reflects the health of these wild stocks. Despite this great news, the fact is that our native stocks of shrimp have been fully exploited for more than 20 years and there is no room for growth in this fishery. The only potential for growth in this important sector of our coastal economy is through aquaculture.

Over the past 3 years, commercial shrimp farming in South Carolina, although a very young and embryonic industry, has in-

creased shrimp landings by an average of 14.5 percent in weight and 16.7 percent in value and has had an average annual economic impact of more than \$5 million. It is not only fair but essential to note that none of this would have been possible without the support provided by the U.S. Marine Shrimp Farming Program.

Now, just how good is this program? I will let the industry spokesman tell you their view of whether the program is helpful to them, but I think you will find that it has been not only helpful, but essential. What I would like to do is look briefly at the quality of the R&D work as evaluated by peer reviews. The Cooperative State Research, Education and Extension Service of the USDA, which administers the funds provided by Congress for the program, subjected the program to detailed scientific peer review in 1988, 1991, and again in 1995.

In 1995, the independent review team highlighted the excellence of the program's management, communication, and cooperation among participants; its planning, development, and integration of major program elements; its high productivity and excellent quality of research products; its direct, highly positive impact on the growth and the profitability of the U.S. marine shrimp farming industry; and its outstanding effort to supply high-health seed to the industry and to develop a sophisticated breeding program for production of improved stocks for farming and the world leadership role of the program scientists. I would like to emphasize that. The world leadership role of our program scientists.

The review team also endorsed the development of environmentally sustainable production systems and the program's exploration of alternative species. A copy of the review team report is included in the information package submitted to you.

From both practical and scientific aspects then, the U.S. Marine Shrimp Farming Program is an outstanding success and we can all be proud of it. As a result, the CSREES has suggested that the program serve as a model for a variety of Government efforts to assist industry development. Much of this success can be attributed to the unique way this program is organized and operated. The institutions that make up the Gulf Coast Research Laboratory Consortium are each represented on an executive committee which sets the general direction and oversees the overall operation of the U.S. Marine Shrimp Farming Program.

Early on, this program identified technologies and products that would provide the United States with a significant competitive advantage in global shrimp aquaculture, and then enlisted the participation of the top research institutions in the country with interests and expertise in these areas. A technical committee, composed of the chief scientists from each participating institution, was established and charged with responsibility for developing a narrowly focused, results-oriented program dedicated to conducting the research required to remove technical impediments to the expansion and profitability of the U.S. shrimp farming industry. This group meets regularly to evaluate the progress, reassess priorities, and ensure that program focus remains on those areas likely to provide the greatest benefit.

The program works in a partnership with the commercial sector to ensure rapid and efficient incorporation of the latest research

findings in commercial technology, and it maintains the flexibility to respond quickly to new high-priority problems and opportunities. As a result of its comprehensive nature, national scope, institutional/industry partnerships, and its focus on critical technologies and the bottom line, the payoffs from this program have been substantial.

These include: a 160-percent increase in pondside value of U.S. shrimp crops from 1991 to 1994; an increase in economic impact from \$23 million annually in 1991 to over \$61 million in 1994; an increase in jobs threefold over this period; and widespread recognition of the United States as the world's leader in the development and export of high-health and improved shrimp stocks, disease diagnostic methods and products, and environmentally sustainable production technologies.

So, what remains to be done? The answer, quite frankly, is a lot. Like other forms of agriculture, there are many technological and other challenges that need to be addressed by a sustained, comprehensive, and coordinated research and development program such as the one we are talking about today.

However, for the near term, the principal impediments limiting further expansion of shrimp aquaculture in the United States in general and particularly in my home State of South Carolina, of which I am particularly concerned, are the following. First, the lack of a dependable supply of healthy, affordable seed stock at the right time of year in sufficient quantities to allow full stocking of all the available ponds. Second, the lack of completely documented and adequately tested methods for disease prevention, control, and eradication and the establishment of diagnostic and certification procedures to ensure the health of seed and brood stock imported for culture. Third, the development of extension of technologies for sustainable production so that potential environmental impacts of shrimp farming, while minor, are essentially eliminated making permit acquisition and maintenance simple and inexpensive. Without permits, new farms cannot be developed and existing farms cannot continue to operate and expand. Finally, there is the lack of genetically improved, high-health shrimp stocks with improved characteristics for intensive cultivation.

In particular, we must immediately deal with the catastrophic threat posed by the spread of viral diseases of shrimp. These diseases are dangerous only to shrimp and most especially farmed shrimp. In 1995, we in the consortium expected a fifth consecutive year of growth and profitability for the U.S. marine shrimp farming industry. However, severe disease-related mortalities were experienced at some shrimp farms in Texas, resulting in a substantial loss of production. The causative disease agents were identified as the same viruses that have caused major problems in South America, Southeast Asia, China, and India.

Since the Texas growers used only high-health shrimp, that is, shrimp and seed documented to be free of these viruses, the initial disease outbreaks are believed to have been independent of the supply of seed stock. This belief is supported by the fact that, thank God, South Carolina was spared such disease outbreaks, although its seed came from the same domestic suppliers as the Texas farms.

Instead, it is now believed, with some circumstantial supporting evidence, that all three viruses entered the United States via frozen shrimp imported for sale in the United States from countries where these diseases are common. Once in the country, the diseases were somehow spread to the farms where the effect was devastating.

It is absolutely vital now that the U.S. Marine Shrimp Farming Program continue and expand its investigation into the possible pathways by which such diseases may be spread to farms, ways to control such spread, ways to treat and hopefully prevent the diseases and losses they cause, and means to eliminate or control any potential dangers to wild shrimp stocks in the United States. This will necessitate continued and expanded efforts on behalf of all participants in the U.S. Marine Shrimp Farming Program, the shrimp farming industry, and additional players such as shrimp importers, processors and distributors, and various Federal and State agencies.

In 1995, South Carolina was spared the devastating effect of these viral diseases and production from our farms was excellent. However, no expansion was possible that year due to the serious concerns over the possibility that major domestic supplies of high-health seed stock might have been contaminated with one or more of these viruses. As a result, South Carolina growers were hampered by a severe shortage of seed. This situation may be worse in 1996 and the threat of possible infection from shrimp products imported into the State is a constant, gnawing fear. This problem must be resolved.

South Carolina, along with several other States, is poised to see a major expansion of commercial shrimp farming with consequent positive economic and job-creating effects on small coastal and rural communities. For this to occur, continuation of the U.S. Marine Shrimp Farming Program, with its emphasis on solving the problems of supply of healthy seed, controlling spread of disease, development and transfer to industry of genetically improved, high-health shrimp stocks and sustainable farming systems, is absolutely vital.

With the program, the U.S. shrimp farming industry will likely grow and become a world model for sustainable, well-managed aquaculture development. Without continuing support of the U.S. Marine Shrimp Farming Program, this nascent industry with its huge economic potential will wither and die.

PREPARED STATEMENT

Thank you again for the opportunity to appear before you. I urge your strongest support for the U.S. Marine Shrimp Farming Program and I would be happy to answer questions at the appropriate time.

[The statement follows:]

PREPARED STATEMENT OF DR. PAUL A. SANDIFER

Mr. Chairman: Good morning. Mr. Chairman and members of the Subcommittee, I am Paul A. Sandifer, Deputy Director for Marine Resources of the South Carolina Department of Natural Resources. I am also a member of the Executive Committee of the Gulf Coast Research Laboratory Consortium, which conducts the U.S. Marine Shrimp Farming Program. Among other activities, I supervise the James M.

Waddell, Jr. Mariculture Research and Development Center in South Carolina, which participates in the U.S. Marine Shrimp Farming Program. My personal background includes 24 years' experience in aquaculture research, development and extension, service on a variety of state and national aquaculture organizations and committees, including the National Academy of Science's Committee on Assessment of Technology and Opportunities for Marine Aquaculture in the United States, publication of numerous technical articles on various aspects of aquaculture, development of state policy and legislation relating to aquaculture, and the education of graduate students.

I thank you for this opportunity to appear before you today to express South Carolina's strongest support for the continuation and expansion of the U.S. Marine Shrimp Farming Program.

The Marine Resources Division of the South Carolina Department of Natural Resources, which I direct, is basically a marine fisheries management agency, but in addition, we have the explicit duty to develop mariculture as a viable enterprise in South Carolina. This is based upon South Carolina's rich history of leadership in the development of marine aquaculture, which began nearly 50 years ago with the work of the late Dr. G. Robert Lunz at the Bears Bluff Laboratories and has continued since 1972 in the Marine Resources Division. As a result of these efforts, in 1977 the South Carolina General Assembly declared: "It is * * * in the State's interest, and it is the State's policy, to encourage the development of aquaculture in South Carolina." (SC Code of Laws.) The State's commitment to aquaculture development was further demonstrated by construction of the Waddell Mariculture Center, which was built entirely with state funds and opened for business in 1984. Since that time, the Waddell Center has become recognized regionally, nationally, and internationally as one of this country's leading aquaculture experiment stations. It is especially well known for its pioneering work on the culture of marine shrimp.

Now, I would like to give you a little bit of information about South Carolina's shrimp farming industry. I will not go into much detail, since Mr. Peterson will be presenting the South Carolina industry viewpoint. However, I would like to give you just a few statistics.

The shrimp trawling industry is by far the most important commercial fishery in South Carolina and has been for many years. In 1995 South Carolina had the highest commercial shrimp landings our agency has recorded since we began keeping detailed catch statistics in 1972. Despite this great news, the fact is that our native stocks of shrimp have been fully exploited for more than 20 years, and there is no room for growth in this fishery. The only potential for growth in this important sector of our coastal economy is through aquaculture. Over the past three years, commercial shrimp farming in South Carolina, although a very young and embryonic industry, has increased shrimp landings by an average of 14.5 percent in weight and 16.7 percent in value and has had an average annual economic impact of more than \$5 million. It is not only fair but essential to note that none of this would have been possible without the support provided by the U.S. Marine Shrimp Farming Program.

Now, just how good is this program? I will let the industry spokesmen tell you their view of whether the program is helpful to them, but I think you will find that it has been not only helpful, but essential. What I would like to do is look briefly at the quality of the R&D work, as evaluated by peer reviewers. The Cooperative State Research, Extension and Education Service (CSREES) of the USDA, which administers the funds provided by Congress for the U.S. Marine Shrimp Farming Program, subjected the program to detailed scientific peer review in 1988, 1991, and again in 1995. In 1995, the independent review team highlighted the excellence of the program's management, communication and cooperation among participants; its planning, development and integration of major program elements; its overall high productivity and excellent quality of research products; its direct, highly positive impact on the growth and profitability of the U.S. shrimp farming industry; its outstanding effort to supply high health seed to the industry and to develop a sophisticated breeding program for production of improved stocks for farming; and the world leadership role of program scientists.

The review team also endorsed the development of environmentally sustainable production systems and the program's exploration of alternative species. In addition, the team recommended that the program: improve documentation of its significant economic impact; assess potential environmental impacts of research activities, such as may be related to introduced diseases; improve production system technology to make the best use of the high health, genetically improved seed being developed by the program; and find ways to lessen the U.S. industry's considerable dependence on the program.

From both practical and scientific aspects, then, the U.S. Marine Shrimp Farming Program is an outstanding success. As a result, the CSREES has suggested that the

program serve as a model for a variety of government efforts to assist industry development. Much of this success can be attributed to the unique way this program is organized and operated. The institutions which make up the Gulf Coast Research Laboratory Consortium are each represented on an Executive Committee which sets the general direction and oversees the overall operation of the U.S. Marine Shrimp Farming Program. Early on this program identified technologies and products that would provide the U.S. with a significant competitive advantage in global shrimp aquaculture, and then enlisted the participation of the top research institutions in the country with interests and expertise in these areas. A Technical Committee, composed of the chief scientists from each participating institution, was established and charged with responsibility for developing a narrowly-focused, results-oriented program dedicated to conducting the research required to remove technical impediments to the expansion and profitability of the U.S. shrimp farming industry. This group meets regularly to evaluate progress, reassess priorities, and ensure that program focus remains on those areas likely to provide the greatest benefit. The Congress, through appropriations to the USDA, has provided sufficient funds to support high quality research, development and technology transfer efforts, with the result that the U.S. now has some clear competitive advantages. The program works in partnership with the commercial sector to ensure rapid and efficient incorporation of the latest research findings into commercial technology, and it maintains the flexibility to respond quickly to new high priority problems and opportunities. As a result of its comprehensive nature, national scope, institutional/industry partnerships, and its focus on critical technologies and the bottom line, the payoffs from this program have been substantial. These include: a 160 percent increase in pond-side value of U.S. shrimp crops from 1991 to 1994; an increase in economic impact from \$23 million in 1991 to over \$61 million in 1994; an increase from 550 to 1,448 in jobs created; and recognition of the U.S. as the world leader in the development and export of high health and improved shrimp stocks, disease diagnostic methods and products, and environmentally sustainable production technologies.

So, what remains to be done? The answer, frankly, is a lot. Like other forms of agriculture, there are many technological and other challenges that need to be addressed by a sustained, comprehensive and coordinated research and development program, such as the one we are talking about today. However, for the near term, the principal impediments limiting further expansion of shrimp aquaculture in the U.S. in general and particularly in my home state of South Carolina are the following:

- (1) Lack of a dependable supply of healthy, affordable seed stock at the right time of year in sufficient quantities to allow full stocking of growout ponds;
- (2) Lack of completely documented and adequately tested methods for disease prevention, control, and eradication, and the establishment of diagnostic and certification procedures to insure the health of seed and brood stock imported for culture;
- (3) Development and extension of technologies for sustainable production, so that potential environmental impacts of shrimp farming, while minor, are essentially eliminated making permit acquisition and maintenance simple and inexpensive (without permits, new farms cannot be developed and existing farms cannot continue to operate and expand); and
- (4) Lack of genetically improved, high health shrimp stocks with improved characteristics for intensive cultivation.

In particular, we must immediately deal with the catastrophic threat posed by the spread of viral diseases of shrimp. These diseases are dangerous only to shrimp, and most especially farmed shrimp. In 1995, we in the Consortium expected a fifth consecutive year of growth and profitability for the U.S. marine shrimp farming industry. However, severe disease-related mortalities were experienced at some shrimp farms in Texas, resulting in a substantial loss of production. The causative disease agents were identified as the same viruses that have caused major problems in South America, Southeast Asia, China, and India. Since the Texas growers used only high health shrimp, that is, shrimp seed documented to be free of these viruses, the initial disease outbreaks are believed to have been independent of the supply of seed stock. This belief is supported by the fact that, thank God, South Carolina was spared such disease outbreaks, although its seed came from the same domestic suppliers as the Texas farms. Instead, it is now believed, with some circumstantial supporting evidence, that all three viruses probably entered the U.S. via frozen shrimp imported for sale in the U.S. from countries where these diseases are common. Once in the country, the diseases were somehow spread to the farms where the effect was devastating. It is absolutely vital now that the U.S. Marine Shrimp Farming Program continue and expand its investigation into the possible pathways by which such diseases may be spread to farms, ways to control such spread, ways to treat and hopefully prevent the diseases and losses they cause, and means to

eliminate or control any potential dangers to wild shrimp stocks in the U.S. This will necessitate continued and expanded efforts on behalf of all participants in the U.S. Marine Shrimp Farming Program, the shrimp farming industry, and additional players such as shrimp importers, processors and distributors and various federal and state agencies.

In 1995, South Carolina was spared the devastating effect of these viral diseases, and production from our farms was excellent. However, no expansion was possible that year due to the serious concerns over the possibility that major domestic supplies of high health seed stock might have been contaminated with one or more of these viruses. As a result, South Carolina growers were hampered by a severe shortage of seed. This situation may be worse in 1996, and the threat of possible infection from shrimp products imported into the state is a constant, gnawing fear. This problem must be resolved!

South Carolina, along with several other states, is poised to see a major expansion of commercial shrimp farming, with consequent positive economic and job-creation effects on small coastal and rural communities. For this to occur, continuation of the U.S. Marine Shrimp Farming Program, with its emphasis on solving the problems of supply of health seed, controlling spread of disease, development and transfer to industry of genetically improved, high health shrimp stocks, and sustainable farming systems, is absolutely vital! With the program, the U.S. shrimp farming industry will likely grow and become a world model for sustainable, well-managed aquaculture development. Without the continuing support of the U.S. Marine Shrimp Farming Program, this nascent industry with its huge economic potential, will wither and die.

Thank you again for the opportunity to appear before you. I urge your strongest support for the U.S. Marine Shrimp Farming Program.

DEALING WITH VIRUS OUTBREAKS

Senator COCHRAN. Let me ask you a question about this virus outbreak before we go on to our other witnesses. Are there other Federal agencies or research consortiums involved in trying to figure out how to deal more effectively with these virus outbreaks? Is this the only consortium that is working on this?

Dr. SANDIFER. To the best of my knowledge, it is the only group that is working on the basic, shall we say life history, the biology of the diseases and what may be done to eradicate it. We have now caught the attention of some public and Federal agencies with regard to the problem of the possible importation of the diseases. My view, at least in the short term, is that this is going to be the only group that is doing effective work in regard to understanding the control of this disease and I'll defer to my colleagues who deal more with that. I deal with consequences rather than the disease.

Senator COCHRAN. Thank you very much. Dr. Walker.

Dr. WALKER. Thank you. Would anybody else on the panel like to respond to the Senator's questions?

Dr. SANDIFER. Senator, let me elaborate on one thing. This consortium, in addition to the research on the biology and what happened as far as these diseases are concerned, is the only group that is developing diagnostic methods that will eventually be used at the farm level, at the State certification laboratory level, to determine whether or not we have clean stocks, that is, stock without the disease, or what caused the particular problem. That is of extreme importance, at least diagnostic methods to find a way for re-development, find a way in commerce that will be available at the farm.

Dr. WALKER. At this time I will ask Dr. Bienfang to get the high points of Dr. Pruder's testimony.

STATEMENT OF DR. PAUL K. BIENFANG, COORDINATOR, U.S. MARINE SHRIMP FARMING PROGRAM, THE OCEANIC INSTITUTE, HAWAII, ON BEHALF OF DR. GARY D. PRUDER

Dr. BIENFANG. Good morning, Mr. Chairman. I am Dr. Paul Bienfang, vice president and co-chief executive officer of the Oceanic Institute. It is my pleasure this morning to represent Dr. Pruder as the consortium coordinator and to provide highlights to Dr. Sandifer's testimony. In the interest of time, I will summarize Dr. Pruder's written testimony.

The U.S. Marine Shrimp Farming Program remains focused on the development and transfer of technology and products and services that will allow for a profitable and sustainable U.S. marine shrimp farming industry to grow. The principal goal of this program is to reduce the U.S. trade deficit by expanding the domestic production of shrimp and by exporting high-technology products and services.

Sustainable and profitable food production industries such as occur in dairies, poultry, and swine, are wholly dependent on healthy domesticated stocks, sophisticated disease prevention and treatment programs, a high degree of environmental control, and advanced culture systems.

The necessary technologies, products, and services for these industries are readily available in the marketplace and have been incorporated as part of those industries that manage them practically. In sharp contrast with this situation in agriculture, the marine shrimp farming industry is comparatively primitive. The vast majority and production depends on wild animals, unsophisticated breeding practices, limited disease programs, and common property use of coastal estuaries.

The U.S. Marine Shrimp Farming Program has elected to help the emerging U.S. marine shrimp farming industry to adopt practices modeled on highly successful terrestrial and aquatic animal and plant production systems. As a result, considerable success has been experienced by the U.S. industry. The growth and profitability of U.S. shrimp farming industry can be directly attributed to this program's development of a specific pathogen free, high-health shrimp stock program. However, this high-health program is only part of a complete production system. High-health seed stocks alone allow for an improvement in production, but they are only an opportunity, not a panacea. The U.S. Marine Shrimp Farming Program has paid considerable attention to development of a complete high-health system not just the feed stocks.

The system integrates high-health stocks with biosecurity and disease control, environmental and water quality, and advanced husbandry methods.

The consortium has pioneered the development of high-health stocks and diagnostic methods. These remain, as the stocks remain, as the only high-health brood stock in the world and gives the United States a tremendous advantage. The U.S. marine shrimp farming industry is capable of following poultry and swine farmers with fast growing, free resistant stocks that will have global markets. The positive impact economically, and this should be significant, is to American shrimp culture domestically and American technology sales internationally.

As addressed by Dr. Sandifer, 1995 was expected to be the fifth consecutive year of growth and profitability for the U.S. marine shrimp farming industry. Instead, the major farms in Texas suffered severe mortality in May 1995, a few months after stocking. The causative agent was identified by the program diagnosticians as the Taura Syndrome virus. During harvest of these animals, not only was Taura Syndrome virus found but two other major viruses, the white spot and the yellow head were also found.

Where do these viruses come from? The seed stock was ruled out because the high-health seed had been continually tested and found to be free of Taura Syndrome, white spot, yellow head, IHNV virus, and other important pathogens for several generations as a captive broodstock. Therefore, the source must have been an outside carrier. States have passed regulations that restrict the movement and import of shrimp broodstock and seed to those that are certified free of specific pathogens. The work done by the U.S. Shrimp Farming Program did not find evidence of illegal importation of live shrimp or broodstock infected shrimp into Texas.

As early as 1994, however, the program recognized the probability that viruses could be carried in frozen shrimp and that large quantities of frozen shrimp from diseased areas are routinely imported into the United States for processing, reprocessing, and retail sales. Hence the U.S. Marine Shrimp Farming Program began to sample and test farm-raised imported frozen shrimp from commercial retailers for imported pathogens.

In the fall of 1995, samples of frozen Asian shrimp that were purchased from a retail store tested positive for white spot using the molecular diagnostic methods. Samples from retailers in Tucson, Alabama, and San Francisco were also tested positive for white spot and the yellow head virus. These findings clearly identified the probable answer to the first question that these diseases came into the country as frozen product.

The U.S. Marine Shrimp Farming Program is leading a dialog to rally interested parties to participate in a study of imported raw frozen shrimp and to complete an impact analysis, identify and confirm pathways, assess the risks, and devise sound resolutions to the concerns. Not only are there concerns among shrimp farmers and processors but also among shrimp fishers and the general public because of a threat that may exist to estuarine waters that support sport and commercial fish and shrimp fisheries.

The U.S. Marine Shrimp Farming Program has begun discussions with the U.S. Department of Agriculture, the National Marine Fisheries Service, and the National Fisheries Institute to provide a forum and incentives for cooperation with shrimp farmers, processors, shrimpers, and other interests to plan and initiate a program to minimize the release and impact of viral pathogens into aquatic systems protecting both aquaculture and sport and commercial fisheries.

A major cooperative opportunity has emerged from the apparent import of foreign viruses. Discussions are underway with the processing industry to measure the risks and to develop sound methods for containment. Mr. Ray Jones, of Rich-SeaPak Corp. will testify later this morning and it is clear that he and his company place

high value on the technology and products developed by the U.S. Marine Shrimp Farming Program.

In addition to continuing to expand the domestic marine shrimp farming industry, we have an opportunity to move and to contribute significantly to assuring the protection of a wide range of aquatic animals and concerns. It will take approximately \$500,000 to initiate a cooperative, high-speed program to improve processing technologies, waste treatment and disposal methods.

PREPARED STATEMENT

Mr. Chairman, I thank you very much for this opportunity to testify. We will submit Dr. Pruder's complete statement for the record. [The statement follows:]

PREPARED STATEMENT OF DR. GARY D. PRUDER, COORDINATOR USMSFP, THE OCEANIC INSTITUTE, HAWAII

Mr. Chairman: It is my pleasure this morning to provide some highlights to augment previous testimony. As Coordinator of the U.S. Marine Shrimp Farming, it has been my pleasure to work directly with the fine scientists and administrators of the member institutions.

The United States Marine Shrimp Farming Program (USMSFP), initiated in 1984, remains focused on the development and transfer of technologies, products, and services that will allow a profitable and sustainable U.S. shrimp farming industry to grow. The principal goal of the congressionally funded program is to reduce the U.S. trade deficit by expanding domestic production of shrimp and by exporting high technology products and services.

BACKGROUND (HIGH HEALTH SHRIMP STOCKS)

Sustainable and profitable modern food production industries (e.g., dairy, poultry, swine, salmon, tomatoes, potatoes, rice, and others) are wholly dependent upon healthy domesticated stocks, sophisticated disease prevention and treatment programs, a high degree of environmental control, and advanced culture systems. The necessary technologies, products, and services for these industries are readily available in the market place and they have been incorporated as part of those industry's best management practices.

In sharp contrast to traditional forms of agriculture, marine shrimp farming is primitive. The vast majority of production depends upon wild animals, unsophisticated breeding practices, limited disease programs, and common property use of coastal estuaries.

The USMSFP has elected to help the emerging U.S. shrimp farming industry to adopt practices modeled on the highly successful terrestrial and aquatic animal and plant production systems. As a result, considerable success has been experienced by the U.S. industry. The growth and profitability of U.S. shrimp farming can be directly attributed to the USMSFP's development of an SPF/high health shrimp stock program. However, an SPF/high health shrimp program is only one part of a complete production system. High health seed stocks alone allow for an improvement in production but they are only an opportunity—not a panacea. The USMSFP has paid considerable attention to development of a complete high health system, not just SPF/high health seed stock. The system integrates high health stocks with biosecurity and disease control, environmental and water quality, and advanced husbandry methods.

CONTROL OF INFECTIOUS HYPODERMAL AND HEMATOPOIETIC NECROSIS VIRUS (IHHNV)

The early motivation for developing a SPF/high health shrimp program in the U.S. was the increasing incidence of runt-deformity syndrome (RDS) in commercial culture throughout the western hemisphere. The increase of RDS in the U.S. was associated with the inadvertent introduction of the virus IHHNV into domestic seed production facilities. In response to the IHHNV epidemic, the USMSFP initiated its SPF/High Health initiative to develop captive stocks of *Penaeus vannamei* that were free of IHHNV as well as other pathogens. Animals were obtained from both the wild and from putative IHHNV-free facilities and subjected to lengthy quarantine and rigorous testing for the pathogens of interest. Animals that successfully completed quarantine were used as founder populations to begin the SPF/High Health

program. They were placed in a high security Nucleus Breeding Center for selective breeding and were also provided to the U.S. industry for eventual production of high health seed for growout.

PERFORMANCE OF THE USMSFP HIGH HEALTH STOCKS

Preliminary field trials in Hawaii, South Carolina, and Texas documented that the USMSFP high health *Penaeus vannamei* consistently outperformed IHNV infected stocks. In a year-long commercial trial, the USMSFP high health stock outperformed other hatchery produced seed and performed at least as well as wild seed. In fact, size and uniformity of the USMSFP high health stock were generally better when compared to wild stock. The adoption of these stocks by the U.S. industry has resulted in profitability and expansion of the domestic shrimp farming industry.

VIRAL DISEASES IN THE UNITED STATES IN 1995

As addressed by Dr. Sandifer, 1995 was expected to be the fifth consecutive year of growth and profitability for the U.S. marine shrimp farming industry. Instead, the major shrimp farms in Texas suffered severe mortalities in May 1995, a few months after stocking with commercially produced high health *Penaeus vannamei*. The causative agent was identified by USMSFP diagnosticians as the Taura Syndrome Virus (TSV); the only previous occurrence of this virus in the U.S. had been an isolated outbreak at two small shrimp farms on the North Shore of Hawaii's Island of Oahu in 1993.

Ponds on the affected Texas farms suffered nearly complete mortality and in an attempt to salvage some production, the USMSFP aided farmers in restocking with *Penaeus setiferus* a shrimp species native to the Gulf of Mexico that was thought to be resistant to TSV. During harvest of these animals not only was TSV found but two other dangerous viruses, White Spot baculovirus (WSBV) and yellow head virus (YHV), were diagnosed by USMSFP personnel in samples of *Penaeus setiferus* harvested from South Texas farms.

Where did the TSV and the other viruses come from? How did they get into the shrimp ponds in South Texas? What do we do about them? To begin to answer these questions, we begin with the two possibilities for their source, (1) in the seed or (2) in some outside carrier. The seed was ruled out because after the outbreaks the broodstock that were the source of the seed continued to test negative for viral agents. In addition, the high health stream of *Penaeus vannamei* has been continually tested and found to be free of TSV, WSBV, YHV, IHNV and other important pathogens for several generations as captive, domesticated stocks.

Therefore, the source must have been an outside carrier. States have passed regulations that restrict the movement and import of shrimp broodstock and seed to those that are certified free of specific pathogens. The USMSFP has not found evidence of illegal importation of live infected shrimp into Texas and so suggests that that was not the route.

As early as 1994, the USMSFP recognized the probability that viruses could be carried in frozen shrimp and that large quantities of frozen shrimp are routinely imported into the United States for processing, reprocessing, and retail sales. Hence the USMSFP began to sample and test farm-raised imported frozen shrimp from commercial retailers for imported pathogens.

In the fall of 1995, samples of frozen Asian shrimp *Penaeus monodon* that were purchased from a retail store they tested positive for WSBV using molecular diagnostic methods. The retail shrimp were selected for testing because they were small and some displayed signs of the disease, including red or pink coloration and white spots in their shells. Samples from retail outlets in Tucson, Alabama and San Francisco, California, also tested positive for WSBV using. The infectiousness of the material was confirmed by exposing SPF *Penaeus vannamei* to the frozen shrimp in a bioassay. This produced mortalities within five days and electron microscope examinations confirmed that the dead indicator shrimp were positive for both WSBV and YHV. These findings have clearly identified a plausible answer to the first question. TSV, WSBV, and YHV could have been introduced with frozen shrimp products imported from diseased areas around the world.

The USMSFP is leading a dialogue to rally interested parties to participate in a study of imported raw frozen shrimp and to complete an impact analysis, identify and confirm pathways, assess the risks and devise sound resolutions to the concerns. Not only are there concerns among shrimp farmers and processors but also among shrimp fishers and the general public because a threat may exist to estuarine waters that support sport and commercial fish and shrimp fisheries.

The USMSFP has begun discussions with the United States Department of Agriculture, the National Marine Fisheries Service, and the National Fisheries Institute

to provide a forum and incentives for cooperation with shrimp farmers, processors, shrimpers, and other interests to plan and initiate a program to minimize the release and impact of viral pathogens into aquatic systems; protecting both aquaculture and sport and commercial fisheries.

SEAFOOD PROCESSING INDUSTRY

A major cooperative opportunity has emerged from the apparent import of foreign viruses. Discussions are underway with the processing industry to measure the risks and to develop sound methods for containment. Mr. Ray Jones, of Rich-SeaPak Corporation, will testify later in the program and it is clear that he and his company put high value on the technologies and products developed by USMSFP.

In addition to continuing to expand the domestic marine shrimp farming industry, we have the opportunity to move and to contribute significantly to assuring the protection of a wide range of aquatic animals and concerns. It will take approximately \$500,000 to initiate a cooperative, high speed program, to improve processing technologies, waste treatment, and disposal methods.

Thank you very much for this opportunity to testify.

DANGER OF IMPORTED VIRUSES

Senator COCHRAN. Thank you. I know you have been looking at the paper prepared by the witness, Dr. Pruder, who is not here. In the statement you summarized, he raises a concern about whether or not there will be any danger to commercial shrimp fisheries from these imported viruses. Do you, or does anyone else on this panel have any information about what threat or what danger, if any, our domestic fisheries are exposed to from these imported viruses?

Dr. WALKER. I would like to address that a little bit and maybe Dr. Lotz can pick up from here. What we are basically finding is what happens sometimes in South and Central America and in the countries that are producing shrimp as we do in this country by other less controlled methods. What they do when they find that their stocks are contaminated with these virus cultures, they simply harvest that pond and process those shrimp for sale and a lot of the sales of those shrimp come into this country.

So for years now there has been an introduction into this country of shrimp products contaminated with the shrimp viruses. As I indicated, these viruses are only dangerous to shrimp not to human beings or other animals. There is an outside chance that the importation of these viruses could be released into our management environment and we are working to preclude that and minimize or eradicate the impact to our natural marine species.

Now, that is what we have done, this is what we are going to hear a little bit more about. We have to develop a way to process these shrimp using technology that will eliminate the discharge of the active disease agents.

Senator COCHRAN. The next witness.

Dr. WALKER. The next witness is Dr. Lotz.

STATEMENT OF DR. JEFFREY M. LOTZ, CO-PRINCIPAL INVESTIGATOR, U.S. MARINE SHRIMP FARMING PROGRAM, UNIVERSITY OF SOUTHERN MISSISSIPPI, GULF COAST RESEARCH LABORATORY

Dr. LOTZ. Thank you, Mr. Chairman, for the opportunity to provide information this morning.

My role this morning is to provide some background on the disease issues involved with the U.S. shrimp farming and also to set the role of the U.S. Marine Shrimp Farming Program within the

context of providing remedies for some of the concerns. And also to highlight some of the opportunities that presently exist for expansion to increase the security and safety of U.S. shrimp farming.

A recent impediment to further expansion of shrimp aquaculture in the United States is the fear generated by the 1995 outbreak of mass mortalities in Texas. The mortalities were attributed to three newly described pathogens. The Taura Syndrome virus which originated in South America and two Asian viruses, the yellow head virus and the white spot baculovirus. None of these three viral pathogens are native to the United States and they were carried into the United States from either Asia or Central and South America where they have devastated the local shrimp farming industry.

The viruses have not only threatened the shrimp aquaculture industries but also pose a danger to the native species of the regions affected. There has been evidence generated that all three of these viruses can affect Gulf of Mexico native shrimp as far as mortality. We don't know what the actual danger of an epidemic in the Gulf of Mexico might be. Recent outbreaks of mass mortalities due to pathogens, once again, brings to the fore the necessity of comprehensive disease control and eradication in aquaculture.

Among the most discussed programs for disease control in aquaculture generally is the U.S. Marine Shrimp Farming Program's specific pathogen free [SPF] initiative. This initiative is guiding the U.S. shrimp farming industry toward becoming what is known as a specific pathogen free based aquaculture industry.

The SPF-based aquaculture industry is one that relies on a continuous supply of animals that are free of specific pathogens. SPF-based industry is organized such as there are three parts of it: the specific pathogen free component, the high-health component, and the commodity production component. The SPF or the specific pathogen free component is focused on a few high security research and development facilities called nucleus breeding centers. These are isolated from other shrimp aquaculture operations.

The long-term goal of these nucleus breeding centers is to provide new strains of genetically improved shrimp to the industry. In addition to genetic improvement, the breeding centers are the source of postlarvae or seed for the rest of the industry. From the nucleus breeding centers, SPF shrimp seed enter into what is known as the medium-security facility of the high-health stream for production of broodstock and eventually seed for use in commodity production.

Why should an industry be SPF based? There are many who suggest that the way to deal with the most devastating disease is to switch to a resistant species regardless of its pathogen status. However, breeding a resistant carrier is unwise for several reasons. Among them are the introduction of pathogens to new areas in which there are susceptible native species. Resistant species also are not resistant to every type of disease. A species may be resistant to one pathogen but not to another so there is no species that is resistant to all.

Also the different species are not often completely unaffected by pathogens even though it appears initially that they are unaffected. Another reason, and perhaps more important, is that resistant car-

riers may be time bombs, particularly if they carry some of the viruses that are presently nonpathogenic. Particularly, certain viruses like the yellow head virus and the Taura virus are notorious in their rapid mutation and perhaps undergo rapid changes. Also, pathogens that are carried in frozen shrimp may be at some point outlawed by importing countries outside the natural range of the pathogen.

The U.S. Marine Shrimp Farming Program has focused in the past primarily on the seed producing components of the industry through the coordinating activities of all six of the members. We have established nucleus breeding centers, founded specific pathogen free stocks, implemented a shrimp collecting breeding program and stock evaluation program, developed numerous diagnostic tools, and generated information on epidemiology, biology, and threat to the native species of shrimp disease agents. We have helped to nurse the development of an infant high-health seed production stream for the U.S. industry by publishing guides, and working with farmers to assure that pathogen status of the domestic seed supply.

Despite the success of that specific pathogen free initiative and the subsequent assurance of the U.S. seed supply, the SPF component is only one piece of a complete disease control effort. The SPF component fits into an overall strategy as that part of the industry that is responsible for seeing diseases are not introduced with the seeds. However, there are four elements necessary for disease control.

One is farm biosecurity and greater care on the part of farmers to ensure that pathogens do not enter the farms.

Another is herd health programs, which is a comprehensive program designed for specific farmers with production goals in mind and overall health management including water management.

The third component is an early warning surveillance to look for and find viruses or diseases that have moved from other countries toward the United States.

And the fourth is that you have a quick response to disease outbreak if one should occur.

These additional arms are already in place in the seed producing components of the industry and now must be implemented in the commodity production growout of the industry. The commodity production growout portion of the industry accounts for most of the activities of what people think of when shrimp aquaculture is mentioned. In addition to being the largest segment of the industry, it is also the most vulnerable to pathogen outbreaks.

The vulnerability can be attributed to several factors. The commodity production [CP] component is composed of operations characterized by large expanses of open water forming large targets for pathogen contamination. The ponds are exposed to large amounts of untreated water during filling and water exchange. The CP growout farms are endangered by the steady flow of human traffic and the unwitting transport of pathogens with stocking, maintaining, and harvesting activities. The large amount of seed that is necessary to stock a growout farm can carry pathogens.

Although the CP stream constitutes the largest and most vulnerable component in a SPF-based industry, it is at the CP stream

that the concepts of SPF and high-health end. Its vulnerability and size preclude the CP stream from the degree of security and surveillance that are required of the seed producing streams.

However, there are specific protections that are available to reduce outbreaks. First, which has pretty much been covered, is the high-health seed program to ensure the status of high-health seeds.

The second area is biosecurity. Opportunities now exist for developing measures for increasing the security of U.S. shrimp growout farms. There is an acute need to determine the risk associated with the importation of cultured shrimp and processing and to develop methods of disinfecting and disposing the solid shrimp waste and liquid waste.

Of equal importance is the development of culture methods that employ reduced water exchange. Further, there is need to develop cultural methods that preclude contamination from airborne methods. Options include pond covers, nursery covers, and bird and insect deterrence methods.

The third area is herd health programs. Management factors such as feeding, water use, and aeration need to be assessed for specific farms and must consider each farm's specific risk for disease outbreaks.

The fourth area is surveillance for early detection. Much concern over outbreaks could be eliminated by development of a network involving farmers, aquatic health care specialists, university scientists, and government agencies to track important pathogens. In the United States, the Centers for Epidemiology and Animal Health have been developed to perform such a function for terrestrial livestock production. Such a network would result in early warning for farmers of the movement of dangerous pathogens into a region. Specific practices could be implemented in the face of an imminent outbreak.

Fifth is the quick response to an outbreak. Should an outbreak occur, there needs to be a set of procedures that can be executed to minimize the cost of an outbreak to the environment, to minimize the risk of contamination to the environment.

PREPARED STATEMENT

Prior to 1995, the U.S. marine shrimp farming industry, with the help of the U.S. Marine Shrimp Farming program, had moved from an unprofitable high-risk endeavor to a profitable medium-risk endeavor. Since the concern over the recent disease outbreaks in 1995, farmers perceive shrimp farming to be a high-risk endeavor again. However, with the development and implementation of a more complete disease control program by the U.S. Marine Shrimp Farming Program, U.S. shrimp farming will become less risky than in other countries.

Thank you very much.

[The statement follows:]

PREPARED STATEMENT OF DR. JEFFREY M. LOTZ

Senator Cochran, a recent impediment to further expansion of shrimp aquaculture in the United States is the fear generated by the 1995 outbreak of mass mortalities in Texas. The mortalities were attributed to three newly described shrimp pathogens: Taura Syndrome Virus, Yellowhead Virus and White Spot Baculovirus. None of these three viral pathogens are native to the United States and they were carried

into the United States from either Asia or Central and South America, where they have devastated local shrimp farming (Attachments I and II). The viruses not only threaten shrimp aquaculture industries but also pose a danger to the native species of the regions affected. The recent increase in outbreaks of mass mortalities due to pathogens once again brings to the fore the necessity of comprehensive disease control and eradication plans for shrimp aquaculture. Among the most discussed programs for disease control and eradication in aquaculture is the USMSFP's Specific Pathogen Free initiative. This initiative is guiding U.S. shrimp farming toward becoming a Specific Pathogen Free (SPF)-based aquaculture industry.

THE USMSFP SPF-BASED INDUSTRY CONCEPT (ATTACHMENT III)

An "SPF-based" aquaculture industry is one that relies upon a continuous supply of animals that are free of specified pathogens. SPF-based industries comprise three components or streams, the SPF stream, the HH (High Health) stream, and the CP (Commodity Production) stream. The SPF stream is focused on a few high-security, research-and-development facilities called Nucleus Breeding Centers (NBC's) that are isolated from other shrimp culture operations. The long term goals of the NBC's are to produce and provide new strains of genetically improved shrimp to the industry. In addition to genetic improvement, NBC's are the source of SPF-postlarvae for the industry. From the SPF NBC's small numbers of SPF seed shrimp of known genetic background flow into the medium-security facilities of the HH stream of the industry for production of broodstock and eventually seed for use in commodity production.

WHY SHOULD AN INDUSTRY BE SPF-BASED?

There are many who suggest that the way to deal with the most devastating disease agents is to switch to a resistant species regardless of its pathogen status. However, breeding resistant carriers is unwise for five reasons: (1) Resistant carriers may introduce a pathogen to new areas with unintended results. The introduction of the IHNV resistant carrier *Penaeus vannamei* into northwestern Mexico in late 1980's resulted in the destruction of the very profitable blue shrimp *P. stylirostris* culture industry. The introduction of the crayfish plague resistant *Pacifastacus leniusculus* into Europe has resulted in the nearly complete elimination of the more susceptible native European crayfishes such as *Astacus astacus*, and the introduction of the nematode resistant Japanese eel *Anguilla japonica* into Europe has threatened the native European eel populations of *Anguilla anguilla* and its culture. (2) Resistant species are not resistant to every pathogen. In the Americas farmers switched to *P. vannamei* from *P. stylirostris* because of the immediate threat to *P. stylirostris* from IHNV. However, Taura Syndrome Virus, is devastating to *P. vannamei* and less so to *P. stylirostris*. A switch back to *P. stylirostris* would now expose the farmer to losses from IHNV. It is well to note that each shrimp species has one or more devastating pathogens associated with it. The development of resistant strains is a long term goal of breeding programs and should be pursued vigorously; however, it is unlikely that breeding programs will ever result in strains that are unaffected by disease organisms. Because shrimp culture is a relatively young industry, more devastating pathogens will be discovered that are presently unknown. Some of these pathogens probably already exist and will become apparent in the unnatural conditions associated with shrimp culture. (3) Resistant species are often not completely unaffected by the pathogens. For example, *P. vannamei* was originally thought to be unaffected by IHNV infections; however, infections that had been transmitted from broodstock to offspring resulted in deformities and poor growth characteristics when placed in nurseries and growout. (4) Resistant carriers may be time bombs. A virus that is carried by a resistant carrier may mutate to a virulent form, e.g., RNA viruses are notorious for rapid mutation and evolution. (5) The pathogen that is carried in the resistant shrimp products may be outlawed by many importing countries outside the natural range of the pathogen. In addition within a country, interstate transport of shrimp seed or product carrying potential pathogens may be banned.

USMSFP PROGRESS

To date the USMSFP has focused on the seed producing components of the industry and through the co-ordinated activities of its six members it has (1) established one SPF-NBC, (2) founded SPF breeding populations, (3) implemented a shrimp selective breeding and stock evaluation program, (4) developed diagnostic tools, (5) generated information on the epidemiology, biology, and threat to native species of shrimp disease agents, and (6) nursed the development of an infant HH seed pro-

duction stream for the U.S. industry by publishing guidelines and working with farmers to assure the pathogen status of the domestic seed supply.

NEED FOR EXPANSION OF DISEASE CONTROL ACTIVITIES

Despite the success of the USMSFP's SPF-initiative and the subsequent assurance of the U.S. seed supply, an SPF paradigm is only one piece of a complete disease control effort. The SPF concept fits into an overall disease control strategy as the arm responsible for reducing the risk of disease outbreaks from infected seed. However, four other elements are necessary to complete a whole industry disease control strategy, (1) farm biosecurity, (2) herd health, (3) early-warning surveillance, and (4) quick response to disease outbreaks (Attachment IV). These additional arms of a comprehensive disease control strategy are already in place in the seed producing components of an SPF-based industry but for an industry-wide disease control program they must be implemented at the level of the growout farms in the CP stream.

The CP stream is the largest segment of the industry, accounts for most of the culture activity, and is what people think of when shrimp aquaculture is mentioned—open pond growout of shrimp for the consumer market. In addition to being the largest segment of the industry, the CP stream is the most vulnerable to pathogen outbreaks. The vulnerability can be attributed to several factors. (1) The CP stream is composed of operations characterized by large expanses of open water forming large targets for pathogen contamination. (2) The ponds are exposed to large amounts of untreated water during filling and water exchange. (3) The CP growout farms are endangered by the steady flow of human traffic and the unwitting transport of pathogens with stocking, maintaining, and harvesting activities. (4) The large amount of seed that is necessary to stock a growout farm can carry pathogens. Although the CP stream constitutes the largest and most vulnerable component in an SPF-based industry, it is at the CP stream that the concepts of SPF and HH end. Its vulnerability and size preclude the CP stream from the degree of security and surveillance that are required of the seed producing streams.

SPECIFIC PROTECTIONS FOR THE CP STREAM

In the CP stream the protections that are available to reduce outbreaks are (1) HH seed supply, (2) biosecurity measures, (3) herd health programs, and (4) surveillance for early pathogen detection, and (5) quick response to an outbreak to reduce the spread of dangerous pathogens to neighboring farms or to the environment.

(1) *HH seed supply.*—The breeding stocks of the USMSFP need to be protected from disease outbreaks. Of primary importance is the development of an indoor NBC. The facility should be completely covered, use only treated recycled water, and should replace raw animal products to induce reproduction. Second, there is a great need for a high security facility for maintaining backup stocks and a breeding program that parallels that of the first NBC. These two steps will ensure the continued supply of SPF for use in U.S. shrimp aquaculture and will form the basis for protecting the genetically improved stocks as they are developed.

(2) *Biosecurity measures.*—Opportunities now exist for developing measures to increase the security of U.S. shrimp growout farms. Of highest priority is the understanding of the epidemiology and mode of transmission into grow out ponds of the most devastating of the pathogens. There is an acute need to determine the risks associated with importation of cultured shrimp for processing and to develop methods for disinfecting and disposing of shrimp solid and liquid waste. Of equal importance is the development of culture methods that employ reduced water exchange. Further there is need to develop pond culture methods that preclude contamination by the airborne routes. Options include pond covers, nursery covers, and bird and insect deterrence methods.

(3) *Herd health programs.*—There is need for increased efforts to assess the progress of the breeding program towards development of shrimp that are both specific-pathogen-free and specific-pathogen-resistant. Advantage should be taken of the opportunities for advancement in disease therapy and the development of vaccine-like pre-treatments. Herd health farm management plans need to be developed and tested in conjunction with farmers. These plans should call for targets of crop growth and production in a disease control context. Management factors such as feeding, water use, and aeration need to be assessed for specific farms and must consider each farm's specific risk for disease outbreaks.

(4) *Surveillance for early detection.*—Much concern over outbreaks could be eliminated by development of a network involving farmers, aquatic health care specialists, university scientists, and government agencies to track important pathogens. In the United States, the Centers for Epidemiology and Animal Health (CEAH) have been developed to perform such a function for terrestrial livestock production,

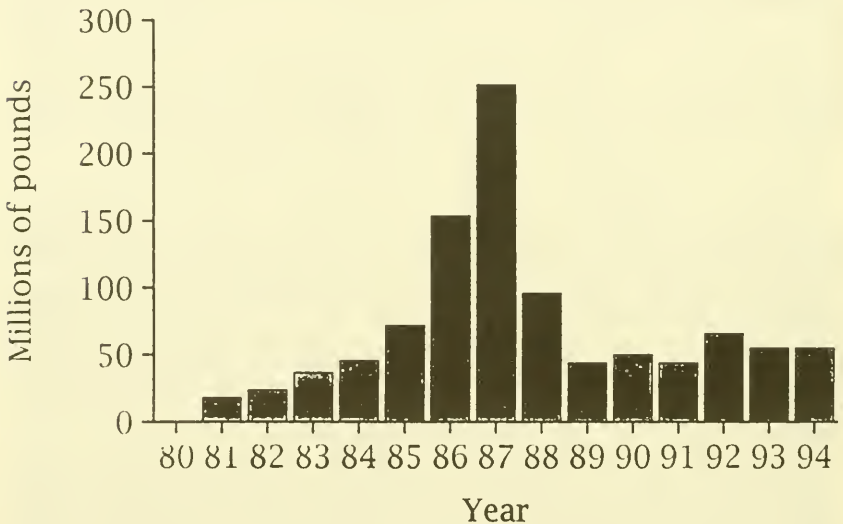
but no aquatic animal pathogens are included. Such a network would result in early warning for farmers of the movement of dangerous pathogens into a region. Specific practices could be implemented in the face of an imminent outbreak.

(5) *Quick response to an outbreak.*—Should an outbreak occur there needs to be a set of procedures that can be executed in order to minimize the costs of an outbreak to the farmer and to minimize the risk of contamination to the environment. Methods for containment, depopulation, and disinfection need to be developed.

Prior to 1995, the U.S. Marine Shrimp Farming Industry with the help of the U.S. Marine Shrimp Farming Program had moved from an unprofitable high-risk endeavor to a profitable medium-risk endeavor. Since the concern over the recent disease outbreaks in 1995 farmers perceive shrimp farming to be a high-risk endeavor again. However, with the development and implementation of a more complete disease control program by the USMSFP, U.S. Shrimp Farming will become less risky than in other countries.

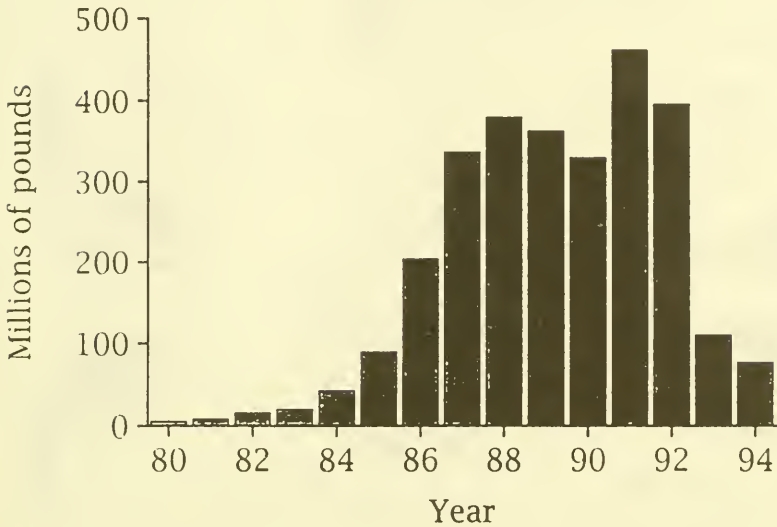
ATTACHMENT I

Production of shrimp - Taiwan



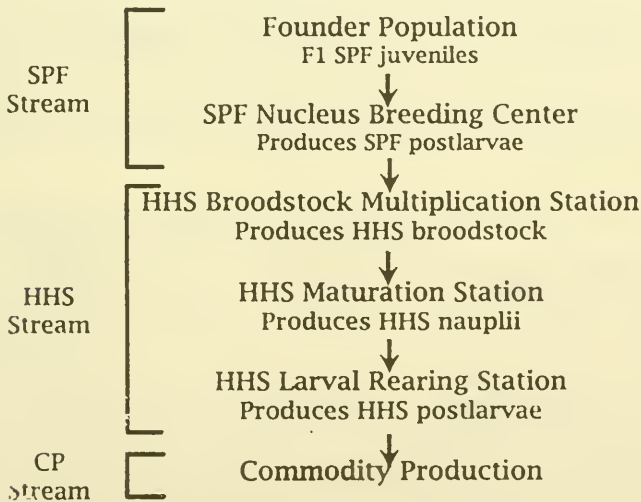
ATTACHMENT II

Production of shrimp: China

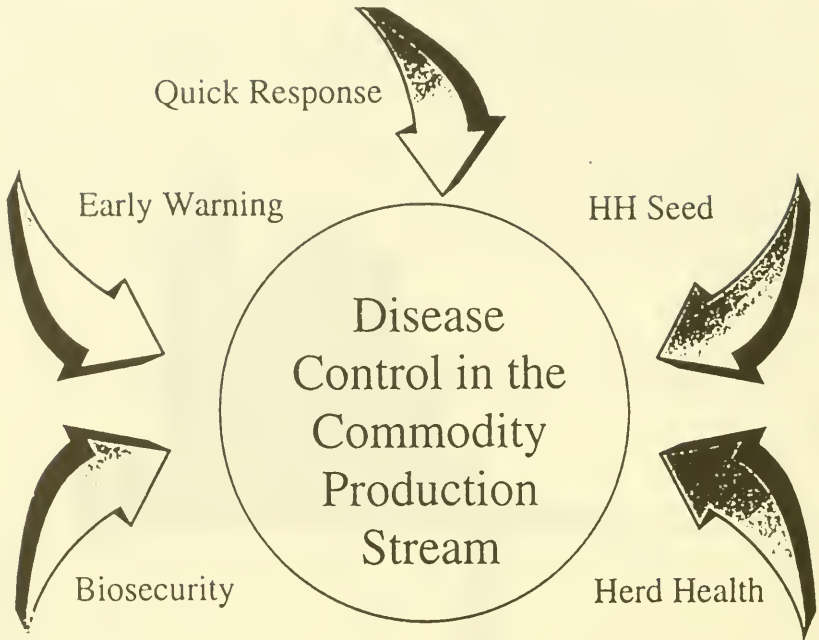


ATTACHMENT III

Organization of an SPF-based industry



ATTACHMENT IV



ATTACHMENT V

Agents of mass mortalities in grow out ponds.

Pathogen	Acronym	Region of Origin
Taura Syndrome Virus	TSV	South America
White Spot Baculovirus	WSBV	Asia
Yellow-Head Virus	YHV	Asia
Infectious Hypodermal and Hematopoietic Virus	IHHNV	?

SHUTDOWN OF IMPORTATION OF SHRIMP

Senator COCHRAN. Thank you Dr. Lotz for your comments and testimony. It is all very technical, the description you have given us with the different kinds of virus. It is going to be a challenge to figure out what to do to combat these virus outbreaks. It is reassuring to hear that there is no threat in your view and Dr. Walker's to humans as a result of these viruses that may be transmitted into the country.

Let me ask you this: You were talking about the importation of the virus that infected the shrimp, how it possibly entered the United States. Is there any shutdown of the importation of shrimp from other countries by our government?

Dr. LOTZ. No.

Senator COCHRAN. Do you anticipate being asked to recommend that in any specific instance or has the scientific community considered recommending that as a way to deal with this?

Dr. LOTZ. I think initially what needs to be done is to assess the real risks. When you first look at the process of the shrimp entering the United States, there is a great deal, over 1 million pounds a month. However, it is not the same kind of shrimp as one might think of as coming off the boats. Most of these shrimp are imported frozen and they can carry, there is no question about it, they carry a number of infections. So they come in frozen and already peeled and go directly to the market so there isn't much processing done. The rest of them come in with tails on, tails only and peeled. The most dangerous portion of the shrimp is the head. Although there is a lot of shrimp coming in, they are a definite possible source.

Senator COCHRAN. Dr. Walker, your next witness.

Dr. WALKER. Let me add to what Dr. Lotz just said. The industry in question in this country is huge and the consortium intends to assist in this matter by working with the processing industry to develop technology and techniques so that the processing of the shrimp in this country will produce this same product as well as the same byproduct. We think our chances for success are very, very high.

Out next witness is our first industry person, Mr. Jeff Peterson, president of the South Carolina's Shrimp Growers' Association. Jeff.

STATEMENT OF JEFFREY J. PETERSON, PRESIDENT, SOUTH CAROLINA SHRIMP GROWERS ASSOCIATION

Mr. PETERSON. Senator Cochran, thank you for inviting me. I am Jeff Peterson, president of the South Carolina Shrimp Growers' Association. I also operate a 16-acre marine shrimp farm near Ridgeland, SC.

I represent a small organization of shrimp farmers. We have about 20 members in southeastern South Carolina.

Prior to farming shrimp in South Carolina, I managed a large American-owned shrimp farm in Ecuador and I was witness to some of these problems that were discussed, the most significant being devastation to crops by these viruses. Believe me, it is something to be respected.

In 1995, South Carolina shrimp farmers produced 1.2 million pounds of heads on shrimp which is an increase of 10 percent over

1994 production. We also produced a small amount of bait shrimp in the farms. Total pondside crop value was in the excess of \$2.5 million. In addition to the direct benefit to the farm operators, South Carolina shrimp farms provide nearly 1,500 jobs in the rural areas as well as generate 540 tons of shrimp feed sales for domestic producers.

In my opinion, the success of the South Carolina shrimp farming industry can be traced to two principal factors. The first being good old American entrepreneurship which seizes on a need and devises the means to address that need. Fortunately in addressing that need we have ample technical support from the Waddell Mariculture Research Center and through them we have help from the U.S. Marine Shrimp Farming Program. In concert with these two groups, they provide timely and competent management assistance. They have developed through the years a formula of investigative strategy for producing shrimp in our area and it has proved to be very successful in the rural areas of the State that have seen a substantial decline in traditional forms of agriculture in recent years.

However, as in any farming endeavor, our source of raw material, that is, the shrimp postlarvae we stock in our ponds, must be of the highest priority. With a quick overview of the South Carolina shrimp production, you will see a very erratic pattern. Prior to 1992, it was mostly due to the unavailability of these broodstocks. We were fishing, hunting and gathering from what we could glean from the environment. However, with the development of the SPF broodstock lines and high-health postlarvae by the U.S. Shrimp Farming Program, farmers now can stock faster growing, better surviving shrimp that significantly outperform nonimproved shrimp. For example, in Ecuador farmers typically produce 35 count heads on shrimp at 35 percent survival using wild postlarvae versus 23 count shrimp at 70 percent survival in South Carolina.

I would say that of equal importance is the continued support of the disease diagnostic research. The gene probe technology allows hatchery operators, growers, and processors to continuously monitor the disease status of their products. Absent the availability of these high technology biotools, producers at all levels must determine the disease status of their products by using time-consuming and expensive bioassay methods.

The continued support of the U.S. Marine Shrimp Farming Program is essential to our business. As a small group, we do not collectively possess the resources nor the technical capability to continue the SPF stock improvement program and without access to SPF broodstock and high-health postlarvae, not only will yields drop to unprofitable levels, the threat of disease introduction may force State regulators to cancel import permits for noncertified postlarvae altogether.

PREPARED STATEMENT

Mr. Chairman, on behalf of the shrimp farmers of South Carolina, as well as those in other shrimp farming States, I urge you to continue your much appreciated support for our industry.

Thank you.

[The statement follows:]

PREPARED STATEMENT OF JEFFREY J. PETERSON

Mr. Chairman: I am Jeffrey Peterson, President of the South Carolina Shrimp Growers' Association. I also operate a 16 acre marine shrimp farm near Ridgeland, South Carolina.

Prior to farming shrimp in South Carolina, I managed a 1,250 acre American-owned shrimp farm in Ecuador, South America, for 12 years. My experience also includes farming fresh water shrimp in Hawaii and catfish in Florida during a career spanning almost 27 years.

South Carolina shrimp farmers produced 1.2 million pounds of heads-on shrimp in 1995 (a 10 percent increase over 1994) from 267 acres of managed ponds. Thirty-six hundred pounds of pond raised bait shrimp were also produced. Total pond side crop value was in excess of \$2.5 million dollars. In addition to the direct benefit to the farm operators, South Carolina shrimp farms provide nearly 1,500 jobs in rural areas as well as generate 540 tons of shrimp feed sales for domestic producers.

The success of the South Carolina shrimp farming industry can be traced to two principle factors: (1) Good old American entrepreneurship, and; (2) Technical support provided by the Waddell Mariculture Research Center and the U.S. Marine Shrimp Farming program.

By providing timely and competent pond management assistance, WMRC has helped over 20 member growers achieve significant aquaculture production in rural areas of the state that have seen a substantial decline in traditional forms of agriculture in recent years.

As in any farming endeavor, our source of raw material, the shrimp post-larvae we stock in our ponds, must be of the highest quality. A quick review of South Carolina shrimp farm statistics will show an erratic pattern prior to 1992 due to the non-availability of improved stocks. Through the development of the SPF broodstock line and high health post-larvae by USMSFP, farmers can now stock faster-growing, better-surviving shrimp that significantly outperform non-improved stock. For example, in Ecuador farmers typically produce 35 count (heads-on) shrimp at 35 percent survival using wild caught post-larvae versus 23 count shrimp at 70 percent survival in South Carolina.

Of equal importance is the continued support of the disease diagnostic research. The gene probe technology allows hatchery operators, growers, and processors to continuously monitor the disease status of their products. Absent the availability of these hi-tech "biotools" and producers at all levels must determine the disease status of their products by using time-consuming, expensive bioassay methods.

The continued support for the USMSFP is essential to our business. As a small group, we do not collectively possess the resources nor the technical capability to continue the SPF stock improvement program—and without access to SPF broodstock and high health post-larvae, not only will yields drop to unprofitable levels, the threat of disease introduction may force state regulators to cancel import permits for non-certified post-larvae altogether.

Mr. Chairman, speaking on behalf of the shrimp farmers of South Carolina, as well as those in other shrimp farming states, I urge you to continue your much appreciated support for our industry.

Thank you.

SHRIMP FARMING'S DEPENDENCY ON CONSORTIUM

Senator COCHRAN. Thank you, Mr. Peterson. I noticed in looking at my materials here that a review team's analysis of this program mentioned there is some concern of the private industry that shrimp farming has become overly dependent, possibly, on the consortium for products and services. Is there any process for continuing contributions by private industry that benefit for the overall policies of the program? Do you have to pay the consortium or reimburse them for any of these benefits you receive?

Mr. PETERSON. I think if you broke down the transfer technology, you would find a combination of technical assistance in general for production-oriented activities. I think they would say that private industry has quite a bit of technology and development. The critical need is the ongoing research and development of the disease-free stocks. Without even consulting our members, I know they would

participate in this economically and with human resources in order to continue this program.

We can't produce breedstock at our own facilities because, as Jeff just pointed out in his testimony, these animals have to be maintained in a disease-free environment. And because we farm the coast of South Carolina, we are subject to introducing pathogens in our area. So, the establishment and funding of these breeding centers is really something that has to be a joint program between governmental and State agencies with economic and human resources.

Senator COCHRAN. Thank you. Dr. Walker.

Dr. WALKER. Our next witness is Mr. Ray Jones with the Rich-SeaPak Corp. in Georgia.

STATEMENT OF RAY JONES, SENIOR DIRECTOR FOR QUALITY ASSURANCE AND REGULATORY AFFAIRS, RICH-SEAPAK CORP., GEORGIA

Mr. JONES. Good morning Senator. I'm Ray Jones, director of quality assurance for the Rich-SeaPak Corp. We are a privately held U.S. corporation headquartered in Georgia. We employ about 1,100 people and we have three plants. We have one in Brunswick, GA, one in Brownsville, TX, and another on the eastern shore of Maryland.

We have been in the processing industry, processing and breeding shrimp since 1947. I would like to give you a little bit of background of the shrimp industry and I am going to quote some statistics from the National Fisheries Institute [NFI]. I would like to say, it's not in my statement but my statement has been reviewed by NFI on everything I have to say to here. NFI, which we know, is the largest trade association representing the seafood industry. They have over 1,100 members in the seafood industry, 1,100 firms.

According to NFI statistics, there are over 200 firms in the United States that actually process shrimp. By this I mean, bread shrimp or somehow process it for further sale to restaurants or distributors. These firms employ over 10,000 people and most of them are small- to medium-sized businesses. Last year the total quantity of shrimp consumed in the United States was approximately 830 million pounds. Of that 630 million pounds was imported, representing wild harvest and aquaculture imported shrimp. And that is up from 360 million pounds from back in 1985.

The domestic shrimp industry has produced consistently about 200 million pounds of shrimp in the last 10 years or so. That 830 million pounds of shrimp just from a raw material value alone would easily be in excess of \$3 billion. If you look at the way the industry is set up, that product turned over a number of times and supports a lot of jobs throughout the United States. It is domestic people, on the domestic side, who catch or harvest shrimp and then it is processed and sold to distributors, who sell it to restaurants or other processors.

On the foreign side, it is the same thing. The product is either caught or farmed and then U.S. importers buy that, bring it into the country and it is sold to the restaurants and supermarkets. As you know, almost every supermarket has some kind of shrimp in there and many of the restaurant chains, especially the larger

ones, are highly dependent on the shrimp industry—Red Lobster, Long John Silvers, Shoney's, Cap'n D's, and many others are big users of shrimp. Shrimp products also require frozen storage and distribution and help support allied industries such as breeding and packaging materials.

Rich-SeaPak is a shrimp and specialty products processor with annual sales revenues of \$250,000,000. Rich-SeaPak enjoys a 45-percent market share of retail coated shrimp and a 75-percent market share of coated shrimp in the warehouse club segment like Sam's. Rich-SeaPak is also a supplier of shrimp and other seafood and specialty products to restaurant chains such as Red Lobster, Long John Silvers, Shoney's, Cap'n D's, and Burger King.

From an industry prospective, the work that the U.S. Marine Shrimp Farming Program has done in the various sectors to date has been very impressive. It has contributed to the development of a U.S.-based shrimp farming industry which began producing several million pounds of shrimp annually. The U.S. Marine Shrimp Farming Program is also responsible for the development of the high-health shrimp stocks which have been used extensively to improve shrimp farming results. Some U.S. shrimp farmers with hatcheries began shipping high-health shrimp postlarvae stocks to other countries which generated significant revenues for the U.S.-based industry.

The U.S. Marine Shrimp Farming Program has also developed some very good diagnostic tools for disease detection and identification. This work has become increasingly important as diseases have become more impactful in the shrimp farming industry. This is not unlike the experience of the chicken farming industry which in the last 40 years has grown from infancy to a mature, sustainable, growing industry which now provides low cost, consistent quality protein for the U.S. consumer and also hundreds of thousands of jobs in the United States. In addition, it has affected virtually every country that raises shrimp.

People love shrimp. It is the most popular seafood there is. The only reason they don't eat any more of it is that the price is too high or there is not enough. So we see a tremendous opportunity there.

Salmon farming has likewise moved from being an industry which was solely based on wild harvest, then an unstable farming industry, to a stable, predictable and growth-based industry in both Norway and Chile.

Programs like the U.S. Marine Shrimp Farming Program are what makes these transformations possible. Shrimp farming and shrimp processing industries need the U.S. Marine Shrimp Farming Program to develop disease-resistant strains of shrimp and to facilitate development of biosecurity measures which prevent transmission of disease from farm to farm, from farm to wild populations to farms.

In my statement there are several paragraphs on issues of foreign shrimp and I've put some of the economic issues in here because as a domestic industry, a domestic processor, we face a number of hurdles with imported shrimp. We process about 10, somewhere between 10 and 20 million pounds of shrimp a year depending on what kind of year we have. Some of that we buy a lot from

the United States, some imported and we buy quite a bit of aquaculture in the United States when available also.

The issues we face and the impact of imported shrimp goes beyond just a negative impact on our balance of trade. When you import shrimp, it takes 2 months to get the product in. There are wild fluctuations in the shrimp market. We may buy something overseas that costs \$5 a pound. Two months later when it gets here before we even process it, the price of shrimp will go down \$1 a pound and we have already taken a tremendous loss.

In summary, as processors, we would love to see more U.S. shrimp available. The quality is excellent. It's easier to come to the gulf or south Texas than to buy shrimp halfway around the world. The industry would love to buy 200 million pounds of domestic shrimp.

As an industry, our focus is on quality, the future, and in protecting the environment. I am sure you are familiar with the FDA's regulations, recent regulations that have recently been published. We supported that, worked with FDA and NFI to bring that about. The whole approach to that program is to identify hazards, hazards to people or hazards to shrimp or shrimp farming. And we think that is the type of approach we need, which is to identify what the hazards are and to put controls in place early in the process to stop those types of things. And as an industry, we are dedicated to quality, quality of our people and products and protecting the environment and the domestic industry.

As I said earlier, we have a plant in Brownsville, TX. In 1993, we invested \$14 million in a new plant down there, and one of the main reasons we did that is because of the development of the shrimp farming industry in south Texas. We believed that the shrimp produced there would be of a higher quality and superior to anything in the world. And, over the last 3 years, we bought one-half of the product that came out of those ponds. The quality was excellent. We would like to get more of that, as much as we can get.

We also, from an environmental standpoint, have been actively involved with Marco Sales, which is a Texas-based organization that has interest in—they have interest in shrimp farms and we have invested over one-half of a million dollars in specialized harvesting equipment to ensure that we have a quality product out of these ponds and to ensure no farm shrimp release into the wild. Our harvesting system has been used as a model by the Texas Department of Wildlife and other shrimp aquaculture areas on how to harvest shrimp to prevent transmission of disease of cultured shrimp into the wild.

We also have, in conjunction with Marco Sales, Ralston Purina and Long John Silver, Pet, funded last year on the Texas coast a zero water exchange. The purpose of that was to experiment with how to reduce the environmental impact of water exchange. As you heard, farms take a lot of water. In the long term, if we develop that technology, that will benefit everybody.

One of the other limited factors of shrimp farming is it has to be on the coast, and land on the coast is very sensitive and you have to have a lot of water moving in and out of these ponds. If we can develop long-term zero exchange shrimp farms, it doesn't

have to be on the coast anymore and we can move inland where the land is a lot less expensive.

We only recently became aware that some of the factors that can cause shrimp diseases are in the frozen, raw shrimp product in the United States, in the U.S. supermarkets and restaurants. We are very concerned about this and we believe the only way to address this thing is a collaborative effort between industry and the scientific community, the U.S. Marine Shrimp Farming Program and the legislative community, to identify the risk and develop practical methods to control this.

I will say from NFI's standpoint, Rich-SeaPak's standpoint, we are concerned about the issues and we can as an industry be successful in doing whatever the right thing is to solve those problems that will include raising funds for cooperative efforts with the U.S. Marine Shrimp Farming Program.

PREPARED STATEMENT

In conclusion, I will say that we think that there is great potential for the domestic aquaculture industry. We think we need the development of technology such as the U.S. Marine Shrimp Farming Program as demonstrated in the past to help bring about this development and we, on behalf of the seafood industry, NFI, and Rich-SeaPak, request that you continue to fund support for this shrimp farming program and possibly include extra funds in that so this industry may grow.

Thank you.

[The statement follows:]

PREPARED STATEMENT OF RAY JONES

Mr. Chairman: According to the National Fisheries Institute, the U.S. Seafood processing industries trade association, there are over 200 firms in the U.S. which process shrimp. These firms employ over 10,000 people. Many of the firms are small- to medium-sized entrepreneurship. The total quantity of shrimp consumed in the U.S. is approximately 830,000,000 lbs. per year. The level of imported shrimp has risen from 360,000,000 lbs. in 1985 to 630,000,000 lbs. in 1994, the last year that full year statistics are available. The level of imports has been rising because the U.S. domestic shrimp industry has been at a total sustainable yield of about 200,000,000 lbs. for a number of years.

The value of the 830,000,000 lbs. of raw material alone would easily be in excess of \$3 billion. When one looks at the structure of the industry, it is clear that the product is turned over and multiplied many times in value:

(1) Domestic processors catch the product, freeze it, sell it to distributors, who sell it to retail supermarkets, processors, or restaurants.

(2) Foreign countries produce and/or farm shrimp. Importers buy frozen product from these foreign sources, then sell it to distributors, retail supermarkets, processors, or restaurants. Every supermarket, and most restaurants in the U.S. handle shrimp. Such highly recognizable restaurant chains as Red Lobster, Long John Silvers, Shoneys, Cap'n D's and many others are big users of shrimp.

(3) Shrimp products also require frozen storage and distribution, and help support allied industries such as breeding and packaging manufacturers.

Rich-SeaPak is a shrimp and specialty products processor with annual sales revenues of \$250,000,000. Rich-SeaPak enjoys a 45 percent market share of retail coated shrimp and a 75 percent market share of coated shrimp in the warehouse club segment. Rich SeaPak is also a supplier of shrimp and other seafood and specialty products to restaurant chains such as Red Lobster, Long John Silvers, Shoneys, Cap'n D's and Burger King, to name a few.

CONTRIBUTIONS OF USMSFP

The work done by the USMSFP has to date been very impressive. It has contributed to the development of a U.S. based shrimp farming industry which began pro-

ducing several million lbs. of shrimp annually. USMSFP is also responsible for the development of the High Health shrimp stocks which have been used extensively to improve shrimp farming results. Some U.S. shrimp farmers with hatcheries began shipping High Health shrimp post larvae stocks to other countries which generated significant revenues for the U.S. based industry.

The USMSFP has also developed some very good diagnostic tools for disease detection and identification. This work has become increasingly important as diseases have become more impactful in the shrimp farming industry. This is not unlike the experience of the chicken farming industry which in the last 40 years has grown from infancy to a mature, sustainable, growing industry which now provides low cost, consistent quality protein for the U.S. consumer and also hundreds of thousands of jobs in the U.S.

Salmon farming has likewise moved from being an industry which was solely based on wild harvest, then an unstable farming industry, to a stable, predictable and growing farm-based industry in both Norway and Chile.

Programs like USMSFP are what make these transformations possible. Shrimp farming and shrimp processing industries need for USMSFP to develop disease resistant strains of shrimp and to facilitate development of bio-security measures which prevent transmission of disease from farm to farm, from farm to wild populations and from wild populations to farm.

ISSUES WITH FOREIGN SHRIMP SUPPLY

There are a number of issues with the foreign shrimp supply. The first is the long lead time for shipment. Over 80 percent of all farmed shrimp comes from the Eastern Hemisphere, notably from Thailand, India, Indonesia, and China. From these locations the time between purchase and arrival is typically over 6 weeks. This necessitates large safety stock inventories to maintain proper service levels to our customers.

The second major issue is the fluctuation in the market price of shrimp. With the U.S. so dependent on foreign supplies, changes in foreign currency valuations, or changes in the strength of the Japanese or European economies can dramatically affect prices. These price fluctuations coupled with the long lead times can cause large losses if commitments have been made to foreign suppliers at a given price and the market declines while the shrimp is in transit.

The third major issue is the rising affluence of the Asian market. With the increase in disposable income in Asia, the U.S. is increasingly competing with the Asian market for supplies, with an obvious freight and geographic disadvantage.

All of these issues are in addition to the negative impact on our U.S. balance of trade.

AN INDUSTRY WITH A FOCUS ON QUALITY AND THE ENVIRONMENT

Contemporary scientific thinking in quality control has centered on analysis and total control of the critical steps of a production process. These scientific quality management programs are sometimes known as HACCP, or Hazard Analysis Critical Control Point programs. The U.S. seafood industry, through its trade association The National Fisheries Institute, has collaborated with the FDA to develop and support implementation of a new quality control program based on these principles. The NFI Technical Committee, which I chair, was responsible for developing Industry's position to present to the FDA. The industry is dedicated to quality and to supplying the consumer with wholesome, consistent and tasty seafood products at a reasonable price.

Rich-SeaPak built a new state-of-the-art \$14,000,000 shrimp processing facility in Brownsville, Texas in 1993, partially due to the development of the U.S. shrimp farming industry in that area. We believe that shrimp produced in those scientifically managed farms will be superior to most other shrimp in the world. Rich-SeaPak has annually for the last 3 years purchased over half of the Texas farmed shrimp crop.

Rich-SeaPak has been actively involved in supporting the development of a high quality, environmentally sound U.S. based shrimp farming industry. Rich-SeaPak and Marco Sales, a Texas based company with interests in both wild production and farmed shrimp, have invested over \$500,000 in specialized equipment to harvest and deliver shrimp from ponds in South Texas which prevent farmed shrimp from being released into the wild and also deliver the highest quality shrimp in the market to the consumer.

Rich-SeaPak, Marco Sales, Ralston Purina, who is involved in shrimp feed manufacture, and Long John Silvers funded a test of zero water exchange with a farm on the Texas coast last year. The purpose of this experiment was to reduce the envi-

ronmental impact from water exchange, reduce the risk of disease transmission, and to make shrimp farming more stable and predictable.

We have recently become aware that diseases can be transmitted by frozen shrimp brought into the U.S. for the supermarket, restaurant, or processing industries. We are concerned about this and believe that a pro-active collaborative effort between private industry, the scientific community (USMSFP), and the regulatory community can best address these issues. We need extensive research to assess the situation and to identify practical methods to control the spread of shrimp diseases.

INDUSTRY'S INTEREST TO DEVELOP FUNDING FOR CONTINUED RESEARCH

Although we have only recently become aware of the possible disease transmission issues, we are concerned about it. The advance notice for this hearing was short, and has not allowed the Gulf Coast Research Lab's consortium and private industry to share the information and to solicit commitments.

Rich-SeaPak sincerely believes that our trade association and individual members of our industry are concerned about these issues and wish to do the right thing to resolve the potential problems. This could include raising funds for a cooperative effort with USMSFP.

REQUEST FOR CONTINUING SUPPORT FOR THE USMSFP

The U.S. shrimp industry believes that the successes that have been achieved with chicken and salmon are models and examples of what can be achieved with shrimp. Development of new disease resistant strains of shrimp, bio-security measures, and other technology are fundamental to this development. We believe that the fine work already done by the USMSFP demonstrates their unique qualifications to continue to develop these technologies. On behalf to the Seafood industry, Rich-SeaPak would like to respectfully request the Senate sub-committee to continue funding support for the USMSFP, and possibly to include extra funds to match those which industry might raise.

Thank you.

PRIVATE INDUSTRY PARTICIPATION

Senator COCHRAN. Thank you very much Mr. Jones. You heard my question to Mr. Peterson as to whether or not private industry is contributing a fair share to the cost of these activities. I guess your comments that the industry would be willing to participate even more and suggest that additional research funds would be made available to the Government as required from private industry answer that.

Mr. JONES. Yes, sir; and, as I said, I have spoken to NFI prior to coming here today and the various trade associations for the seafood industry and they are definitely for that.

Senator COCHRAN. Thank you very much. Dr. Walker.

ADDITIONAL MARINE AQUACULTURE ACTIVITIES

Dr. WALKER. We are going to take the few minutes that we have left and talk about additional marine aquaculture activities that the consortium is involved with. Dr. Paul Bienfang from the Oceanic Institute is going to take a few minutes to talk about the area of stock enhancement or stock implementation and safety of our marine resources.

As the gap between our ability to produce seafood from our natural systems widens between that and the demand for those products, we have to turn more and more to aquaculture to meet that demand. That is not saying necessarily that our natural stocks are impaired biologically, it is just that the production as seen with shrimp has been maximized for a number of years.

Well, the same the same thing is true with some of our finfish species and so it is harder and harder to meet the demand, the

growing demand for seafood. Technology has been developed for some species and we hope to transfer that technology to Mississippi, as well as to develop the technology for the additional species.

Dr. Beinfang.

STATEMENT OF DR. PAUL K. BIENFANG, CO-CHIEF EXECUTIVE OFFICER, THE OCEANIC INSTITUTE, HAWAII

Dr. BIENFANG. Thank you again, Mr. Chairman and your subcommittee, for the very strong and positive support you have provided for aquaculture throughout the past years. The programs at Mississippi State University, the University of Southern Mississippi, the Stoneville Laboratory, and the Oceanic Institute have all achieved significant results, thanks to your support. These important programs stand as examples of how to rapidly and efficiently expand America's economic potential in aquaculture. I'll summarize my written testimony in the interest of time.

Today I would like to highlight an additional area of opportunity in the face of a growing tragedy. U.S. coastal fisheries have drastically declined during the past decade, but increased fishing effort and product substitution has concealed those declines. Nature cannot keep up with the increasing world demand. This is causing a loss of jobs, revenue, and decrease in commercial and sport fishing opportunities. Depletion in coastal fisheries is already widespread. Both recreational and commercial fisheries have been hit hard along the eastern seaboard, gulf coast, the west coast, and the Hawaiian Islands.

Mississippi coastal fishing is part of this supply. Mississippi has a vital interest in increasing its production of seafood products and it has the resources and expertise that can be mobilized and provide talents available through research collaboration from other States to meet the challenge of accelerating seafood production through the enhancement of fisheries stock.

Considerable advancement has been made in Hawaii, and that technology can be transferred to Mississippi in cooperation with the Oceanic Institute. For some of our high-value species, declines in coastal fisheries can be reversed using new technologies developed for marine stock enhancement as an additional fishery management tool. State-of-the-art hatchery and release techniques now provide a powerful and responsible mechanism for supplementing and replenishing marine fisheries. Enhancement can also be used to transfer fishing pressure from wild stocks to cultured fish. Although enhancement technology has long been used for anadromous species such as salmon, trout, and striped bass, only now are programs beginning to apply stock enhancement to species that spawn in marine environments.

Using pilot scale hatchery releases, scientists at the Oceanic Institute in Hawaii are already showing the potential of this new technology to provide substantial increases in marine fish abundances and recreational fishery yields. The results of even experimental scale release in selected environments in Hawaii have shown that after several releases, 25 percent of the animals that come out of the captured fishery are stock that came out of these experimental programs.

They are extremely popular with the whole fishing community and with the fisheries' managers who see it as an additional tool that they can use. With this new and rapidly developing marine enhancement technology, policymakers have an additional tool for managing coastal fisheries.

To kick start aquaculture-based enhancement of coastal fisheries in the United States, a consortium modeled after the successful model of the U.S. Marine Shrimp Farming Consortium could establish marine enhancement prototypes at strategic locations in the United States by: (1) networking with State, Federal, and community resource organizations and identifying technical players; (2) selecting species targets and identifying training needs and setting up a hatchery prototype infrastructure; (3) selecting appropriate consortium entities; and (4) transferring stock enhancement technology proven in the Hawaiian Islands to the U.S. mainland setting.

The success of the consortium prototypes, coupled with training conducted by the consortium will stimulate expansion of the application of this tool in the United States and provide new products for aquaculture hatchery products in these States.

In summary, Mr. Chairman, the goal of this initiative is to supplement and rehabilitate declining U.S. fishery resources and threatened coastal fishing industries. To achieve the goal, our Nation needs a coordinated, focused restoration initiative led by a consortium involving key U.S. coastal States. The consortium will implement new marine enhancement technology in an effective and environmentally sensitive manner.

The consortium's objective is to expand this potential of aquaculture, to provide fishery managers at both Federal and local levels a proven technology to supplement and rehabilitate coastal fisheries in the United States by cooperating with appropriate public resource agencies to establish a responsible marine stock enhancement capability nationwide.

PREPARED STATEMENT

Congressional support is necessary to initiate a marine stock enhancement consortium and offset a serious threat to our fishing industries. In fiscal year 1996, \$1.6 million is needed to help begin recovering coastal fishing industries by targeting recreational fisheries initially, when the impact can be very high. This is an opportunity for these States' leadership in aquaculture to be focused on providing an important part of the solution to this national tragedy.

I thank you very much for the opportunity to speak.
[The statement follows:]

PREPARED STATEMENT OF DR. PAUL K. BIENFANG

Mr. Chairman: I wish to take this opportunity to thank both of you and your committees for the very strong and positive support you have provided for aquaculture throughout the past years. The programs at Mississippi State University, the University of Southern Mississippi, the Stoneville Laboratory, and The Oceanic Institute, have all achieved significant results, thanks to your support. I urge you to continue and to expand your support for this work. These important programs stand as examples of how to rapidly and efficiently expand America's economic potential in aquaculture.

Today, I would like to highlight an additional area of opportunity in the face of a growing tragedy. U.S. Coastal fisheries have drastically declined during the past decade. But increased fishing effort has concealed those declines. After a steady increase in fishing effort, worldwide marine fisheries yield finally peaked at 100 million metric tons in 1990 and has since remained below that level. Nature cannot keep up with the increasing world demand for seafood. This is now causing loss of jobs and revenue, and a decrease in commercial and sport fishing opportunities.

Today's ocean fisheries face enormous risk of continued severe depletions. The U.S. already runs a net seafood import deficit of \$4.9 billion per year. As human population size doubles by the year 2035 (FAO statistic), our coastal fisheries will continue to be exploited at a non-sustainable pace. Fishery related industries will face devastating economic losses, and the seafood deficit will worsen. Both commercial and sport fishing as we know it in marine environments will pass from existence during the next century.

Depletions of coastal fisheries in the U.S. are already widespread. Both recreational and commercial fishery industries have been hard along the Eastern seaboard, Gulf Coast, West coast and Hawaiian islands (National Marine Fisheries Service statistics). All U.S. coastal regions face a common problem—limited resources to meet increasing demand, a demand for seafood products that is growing along with population size, boat size and gear effectiveness.

Mississippi's coastal fisheries are a part of this decline. Mississippi has a vital interest in increasing its production of seafood products. Mississippi also has the resources and expertise that can be mobilized and combined with talents available through our research collaborations with other states to meet the challenge of accelerating seafood production through enhancement of fisheries stocks. We need to develop a marine aquaculture program that can contribute to and capitalize on the rapidly growing fields of marine stock enhancement and sea farming. Mississippi is presently well-positioned to assume a leading role in developing technology required to produce marine fish and invertebrates on land through marine aquaculture techniques as well as to expand agriculture into the sea. Considerable advancements in these areas have been made by consortium members in Hawaii, and that technology can be transferred to and expanded in Mississippi, in cooperation with the Oceanic Institute.

For some of our high-value species, declines in coastal fisheries can be reversed using new technologies developed for marine stock enhancement as an additional fishery management tool. State-of-the-art hatchery and release techniques now provide a powerful and responsible mechanism for supplementing and replenishing marine fisheries. Enhancement can also be used to transfer fishing pressure from wild stocks to cultured fish. Although enhancement technology has long been used for anadromous species (i.e., salmon, trout and striped bass), only now are programs beginning to apply stock enhancement to species that spawn in marine environments. Using pilot-scale hatchery releases, scientists at The Oceanic Institute in Hawaii are already showing the potential of this new technology to provide substantial increases in marine fish abundances and recreational fishery yields. Norwegian scientists are showing a similar enhancement potential for Atlantic cod. With this new and rapidly developing marine enhancement technology, policy makers have an additional tool for managing coastal fisheries.

Stock enhancement technology can channel under-utilized ocean energy into seafood production needed to meet world food demand. Surplus ocean productivity is created when fishing reduces stocks below the environmental carrying capacity, leaving wild forage available, but unused. By harnessing this surplus energy, stock enhancement may become a primary technology for producing additional protein needed to feed the expanding world population. With this technology in hand, the U.S. could become a leading seafood exporter.

Other nations are already using this technology to expand agriculture production from land based systems into the open sea. Tapping surplus food energy in the ocean is the focus of Japan's national stock enhancement program (called "sea ranching"). We must act now to build this new industry in the U.S. to remain competitive in the world seafood market.

Scattered throughout the U.S., there are several groups that are independently developing stock enhancement tools for specific species and localities. In particular, the Gulf Coast Research Laboratory and The Oceanic Institute have successful programs in aquaculture and fisheries enhancement.

To kick start aquaculture-based enhancement of coastal fisheries in the U.S., the consortium will establish marine enhancement prototypes at strategic locations in the U.S. by: (1) networking with state, federal, and community resource organizations and identifying key technical players; (2) selecting species targets, identifying training needs, and setting up the hatchery prototype infrastructure; (3) selecting

appropriate consortium entities; and (4) transferring stock enhancement technology, proven in the Hawaiian Islands, to the U.S. mainland setting.

The success of the consortium prototypes, coupled with training conducted by the consortium, will stimulate expansion of the application of this tool in the U.S. The consortium will be guided by principles for responsible marine enhancement, developed by The Oceanic Institute. These principles, recently recognized by the American Fisheries Society, include such factors as species selection, adaptive management strategies, genetics, health, environmental impact, ecological factors, monitoring enhancement impact, improving release strategies, and economics. By advocating these principles as guidelines, the consortium will provide directed and responsible development of enhancement prototypes, which will maximize the potential for success.

The stock enhancement consortium will provide a unified vehicle for implementing a focused and environmentally sensitive approach to marine fishery enhancement. A strategic plan will be developed for integrating enhancement technologies into fisheries management practices. The consortium will develop or adapt aquaculture technologies and test prototypes at strategic locations in the U.S. This will provide a model for expansion of enhancement technology. The consortium approach will be much more efficient than developing independent enhancement programs in each coastal state.

This consortium will enhance various kinds of marine fisheries in the U.S. Using new technology for marine enhancement, the opportunity exists now to have a rapid impact on recreational fishery yields. For sport fisheries, the per capita impact of enhancement can be greater, and will affect a broader segment of the American public, than in commercial fisheries (i.e. 10,000 fish can be harvested by a single commercial fisherman or could satisfy 1,000 sport fishermen).

The initial output from the consortium will be 2 tested prototype enhancement programs, one targeting inshore fisheries in the north central Gulf of Mexico, the other in Hawaii where stock enhancement will be advanced into the realm of pelagic fisheries. Participation will eventually be expanded to other regions and other fisheries in the Gulf of Mexico, the Hawaiian Pacific, the eastern Pacific and the western Atlantic. As the developing U.S. stock enhancement technology expands, commercial fisheries can eventually be targeted.

The National Research Council in a 1992 study on "Marine Aquaculture: Opportunities for Growth" states, "Public agencies should promote the participation and increase the role of the private sector and the free market system in meeting the nation's needs for fish and shellfish for stock enhancement efforts."

Cooperative ventures involving public (resource) agencies and private industry will be promoted. Enhancement efforts will spawn new opportunities for commercial aquaculture by developing technology to culture new species and providing new market opportunities. Also, the commercial aquaculture industry will bring efficiency and cost-effectiveness to hatchery production of fish for release. The fishing industry, with a stake in the enhancement process, will protect the enhanced resource to ensure benefits are received.

This timely support for recreational and commercial fishing will help stimulate our economy, initiate a marine stock enhancement industry, lay the framework to develop sea ranching in the U.S. and keep the U.S. competitive in global trade of fisheries products.

In summary, Mr. Chairman, the goal of this initiative is to supplement and rehabilitate declining U.S. fishery resources and threatened coastal fishing industries.

- To achieve this goal, our nation needs a coordinated, focused restoration initiative, led by a consortium involving key U.S. coastal states. The consortium will implement new marine enhancement technology in an effective and environmentally sensitive manner.

- The consortium's objective is to expand this potential of aquaculture, to provide fishery managers at both federal and local levels a proven technology to supplement and rehabilitate coastal fisheries in the U.S. by cooperating with appropriate public resource agencies to establish a responsible marine stock enhancement capability nationwide.

Congressional support is essential to initiate a marine stock enhancement consortium and offset a serious threat to our fishing industries. In fiscal year 1996, \$1.6 million is needed to help begin recovering coastal fishing industries by targeting recreational fisheries initially, where the impact can be very high. This is an opportunity for these state's leadership in aquaculture to be focused on providing an important part of the solution to this national tragedy.

Senator COCHRAN. Thank you very much. Let me ask you this: the funding that you mentioned, has it been included in any other

appropriations bill that you know of—in the Commerce appropriations bill?

Dr. BEINFANG. No, sir; there is a separate funding that comes through the National Marine Services to do a continuous stock enhancement effort on a carnivorous species in Hawaii. This is important to transfer the technology and adapt it to a coastal setting.

Senator COCHRAN. It sounds very interesting. I would like to welcome you, those of you who are interested in that, to see and explore getting funds to start that kind of initiative program. Dr. Walker.

SUMMARY OF FOREGOING TESTIMONY

Dr. WALKER. Thank you. It is my pleasure now to summarize the foregoing testimony. I think that the witnesses have done an excellent job in portraying the Gulf Coast Resource Laboratory and Consortium in the Shrimp Farming Program. It is vital to a very young and potentially growing industry that has a very high potential of success. I think the take-home message is that farming is a durable thing. It could be a good thing for the country and it can be a profitable industry along the lines of the poultry, swine, and beef industry that we depend on for substance today. I think we have to realize at this point and time that without the consortium, this industry will fail and the potential will be lost.

I think we also need to reiterate or mention the fact that this program was designed, the shrimp farming program itself and the consortium, to be funded initially with the Federal Government and for that Federal support to decline in time. And, we are not at the point now where we can do without the Federal support, but we think we see the light at the end of the tunnel and we think it might not be a train.

So, I would say probably between 5 to 7 years from now, the Federal support for the program will be much less important than it is now. If the consortium and program were to continue, it would be later industry-funded. So what we are basically asking today is that your subcommittee consider in fiscal year 1997, \$4 million of Federal support for continuing consortium activities similar to what we have been talking about today, exclusive of the disease processes; and an additional \$2 million to work for improved disease control, breeding, quarantine, and seed production facilities. This would be a one-time request, not recurring. This would be to get our disease program under control to address the concerns of that that have been stressed today.

We request \$500,000 in matching money to supplement the money that we have been talking about from the industry to work with the processing activities associated with the seafood processing industry, for a total of \$6.5 million for the U.S. Marine Shrimp Farming Program for fiscal year 1997.

With respect to support for the GCRL Stock Enhancement Consortium, I will say that the State of Mississippi has appropriated some \$200,000 last year for this activity here in Mississippi and it is a good likelihood that additional funding probably in the \$300,000 to \$400,000 range will come this year. These moneys are considered seasonally to establish a basic disease center, a stock enhancement center in Mississippi and we are requesting an addi-

tional \$1.6 million in Federal support to allow that program to develop fully.

PREPARED STATEMENT

This concludes the testimony from this panel. We thank you for the opportunity to present this to you and thank you very much. [The statement follows:]

PREPARED STATEMENT OF DR. WILLIAM W. WALKER

Mr. Chairman: It is my pleasure to summarize the foregoing testimony and to formalize our request for continued congressional support.

Due in large part to the Gulf Coast Research Laboratory's U.S. Marine Shrimp Farming Consortium, the United States is today recognized as the world leader in technologies, products, and services for advanced or second generation shrimp farming operations.

The Consortium has also contributed advanced molecular diagnostic tools and procedures and currently maintains the only lines of high health and genetically improved shrimp stocks. These high health shrimp are of critical importance to the emerging U.S. shrimp farming industry.

Recent meetings of the World Aquaculture Society confirmed the ongoing turmoil in foreign shrimp farming operations. Shrimp diseases are essentially out of control in foreign countries. Sick shrimp are being harvested and exported before they die of disease infections, lowering the quality of imported shrimp.

U.S. shrimp farmers have had but a taste of disease problems overwhelming foreign shrimp farmers. However, with high health stock, disease screening, cooperation with shrimp processors, and biosecurity, U.S. farmers will avoid decimating losses due to shrimp mortalities.

The USMSFP has demonstrated its capabilities to address difficult problems in an effective manner. The USMSFP must continue its investment in disease diagnosis, prevention and control, genetic improvement of stocks, and environmental quality. The program is also prepared to embrace special opportunities in cooperation with the processing industry to minimize or eliminate the release of exotic viruses. Such an effort promises dividends in jobs and economic benefits of billions of dollars.

However, it must be clearly understood that the resources necessary for continuation of USMSFP are those recommended by your committee and provided by the U.S. Congress. If this support is not continued, the U.S. marine shrimp farming industry will simply die. Problems with the import of exotic viruses will grow to the extent that shrimp processing and retailing as we know it today in this country will no longer exist. In the process, the United States would lose its opportunity to lead a worldwide industry away from turmoil and into a partnership and balance in trade.

We are most appreciative of the support to date and respectfully request the following funds for the USMSFP in fiscal year 1997.

Support for USMSFP

(Shrimp breeding, disease diagnosis, prevention, and treatment, environmental protection)	\$4,000,000
Facility Capital Support for USMSFP (one time) (Improved disease control, breeding, quarantine, and seed production facilities)	2,000,000
USMSFP for control of exotic viruses in cooperation with the Seafood processing industry. (Screening, tracking, treating and eliminating the viral threat to aquatic systems)	500,000

Support for GCRL Stock Enhancement Consortium

To form and initiate a new GCRL Consortium to develop and transfer technologies to enhance, supplement, and rehabilitate Mississippi's marine fisheries resources	1,600,000
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SUMMARY REMARKS OF SENATOR COCHRAN

Senator COCHRAN. Thank you Dr. Walker. I appreciate your help in organizing this panel's testimony the way that you have. I think that you have given a very good view of several problem areas and

the need for research and how we can go about better enhancing our ability to promote the growth of our domestic shrimp industry, both shrimp farming and through the enhancement of our fishery stocks. I think this is a very challenging area.

We talk about the fact that we started this in 1984 with some money to create a program because we were worried about the trade deficit in marine shrimp, the gap between the demand and the production of domestic shrimp. Since that time, we have seen a leveling off really of some initial growth in the domestic production, and continue to rely on the importation of shrimp to meet the growing national demand. So, I think that in a nutshell describes what our dilemma still is. We are still having problems although we made a lot of progress.

Dr. Sandifer pointed out specific areas of growth in South Carolina. Those were impressive. But this has not really been replicated around the country and it is unique. They ought to be congratulated for the progress they have made.

We can all learn from the testimony that we had today. I think our subcommittee will benefit from it. We will carefully review your requests for specific funding of these activities for the next fiscal year.

Thank you all for being here, you did a great job. We are going to take a 15-minute break here and then our second panel will come in.

[A brief recess was taken.]

PANEL TWO—MISSISSIPPI STATE AQUACULTURE RESEARCH

INTRODUCTION OF WITNESSES

Senator COCHRAN. I appreciate very much the second panel assembling before us. I want to thank Les Serrano, who is our court reporter, for doing such a good job, keeping up with what everybody is saying to record the testimony here.

And let me also say this, while we organized the hearing and have a fairly tight schedule, anyone who wants to present testimony, as these witnesses have prepared and given testimony, on these subjects or any matters related to the purpose of this hearing, should feel free to do so.

I have discussed with a couple of people in the audience their thoughts about some of the subjects that have been discussed, and I want to be sure that our hearing record contains any comments from anyone who would like to submit them for our hearing record. So, I would like you to do that. You can put it in a letter form; you can have it in a formal statement and submit it to me and I will ensure it is later made a part of the hearing record and is fully considered by the subcommittee as any of the testimony that is presented today by the panels.

Our second panel today is made up of people who will be discussing Mississippi State University's research activities. Dr. Verner Hurt is the director of the Mississippi Agricultural and Forestry Experiment Station. I am going to ask him to introduce the panel of witnesses with him and make whatever comments he would like to by way of introduction and then call on the other witnesses who

will be a part of this panel to discuss with us certain programs under their jurisdiction.

Dr. Hurt, welcome.

STATEMENT OF DR. VERNER G. HURT, DIRECTOR OF THE MISSISSIPPI AGRICULTURAL AND FORESTRY EXPERIMENT STATION, MISSISSIPPI STATE UNIVERSITY

Dr. HURT. Thank you Senator Cochran, I appreciate very much the opportunity to appear before the subcommittee today. We have with us today Dr. Palmertree who is from the Extension Service who will make a few comments. Dr. David Veal who heads the Coastal Aquaculture Center, and he has put together a panel of members of his staff who we will introduce later as we proceed with the program.

I have the enormous task of trying to give you an overview of the many various programs that exist in Mississippi State University in support of aquaculture. As you know, we are a land-grant university. Research is important. We learned many years ago that without the extension arm to get this technology transferred to users, we were fighting a losing battle. I think you will see today excellent examples in cooperation between research and extension.

I have a formal statement that I have submitted for the record. I will not go through all of it in the interest of time but I do want to mention a few high points.

I think you have heard how important marine fisheries are to this State. We have a long history. Our emphasis has been primarily on freshwater, warmwater aquaculture relative to freshwater species even though we have, and you will hear about, some activities in support of the programs we have in the State.

Aquaculture is one of the fastest growing segments of U.S. agriculture and nowhere is it more evident than Mississippi. Mississippi ranks No. 1 in the United States in catfish production. In 1994, the farm value of catfish in Mississippi was more than \$250 million. The overall impact was more than \$2 billion. So much of the upstream impact of goods and services and downstream impact, processing and marketing, take place in the State.

Mississippi is in a unique position from the standpoint of natural resources and environment, scientific and technical expertise, and commercial infrastructure to capitalize on the growing demand for aquacultural products. We think we have an excellent opportunity and incentive based on State and Federal sponsorship of research programs which focus the efforts of numerous scientists dealing with the production and quality of farm-raised catfish and other species.

We are involved in, as you well know, many activities that relate to warmwater aquaculture and I want to highlight those for you here. More specific, I would like to discuss the programs on the gulf coast.

Most of our efforts are the results of partnership and I can't not recognize the partners that we have in our research and extension program. The Cooperative State Research, Education, and Extension Service; the Agricultural Research Service; the USDA; the U.S. Agricultural Marketing Service; and many others, have contributed greatly to our success in supporting this agricultural industry. Catfish research programs were first initiated at the main

campus and at the Delta Branch Experiment Station at Stoneville with funding from a special grant from the USDA.

We completed construction of 141 research ponds and a supporting aquaria facility is completed, and research is underway at these facilities.

We will begin construction shortly on the office and laboratory facility and we are in the process of recruiting additional staff. When completed, the National Warmwater Aquaculture Research Center will be the premier research facility of this type in the world. I do not think there is any question about that.

We have other sources of funds, and I will not go into a lot of detail about it. Funds for the research at the Stoneville Aquaculture Research Center, together with funds received through the National Warmwater Aquacultural Research Center, underwrite a major effort dedicated to water quality, catfish nutrition, and related areas. I think we have made progress, but there are still a lot of problems with some of the programs that are mentioned in the statement that have yet to be addressed.

Catfish off-flavor has been identified as the most serious problem as far as the catfish industry. At present, there are no reliable methods available to prevent off-flavor episodes in fish ponds. That is, neither reliable preventive measures nor methods to predict and control or abate off-flavor episodes have been developed. However, scientists have correlated the occurrence of certain species of blue-green algae with off-flavor episodes and we now have a predominant algae species in continuous culture. Thus, we expect to achieve a rapid increase in our knowledge and ways to control this problem.

We have a current joint effort with the College of Veterinary Medicine and industry is evaluating the efficiency and safety of diuron as a control mechanism for this blue-green algae and this looks very promising. And, I think I should point out that the College of Veterinary Medicine of Mississippi State University is the only college of veterinary medicine with a program on fish health and fish diseases. We work very closely with them. The Mississippi Center for Food Safety and Postharvest Technology is dedicated to the development of technologies related to catfish products. Scientists have significantly increased our standing on seafood safety issues related to the industry. Several areas of research are underway to focus on the use of antimicrobial agents in processing plants, early detection and prevention of the occurrence of human pathogens in or on finished products, rapid screening tests for antibiotic residues in finished products, and packaging and extended shelf life of products.

Technologies that are developed in this program will allow us to avoid the occurrence of food-related health risks associated with the contamination of foodstuffs irrespective of their points of sale and consumption. It will certainly enhance our ability to capture the value added from further processing of our traditional raw agricultural products.

Aquaculture research programs also address the problems in harvesting, processing, and marketing catfish and other species, and production of alternative species including freshwater shrimp, crayfish, and hybrid striped bass.

The seafood and aquaculture processing, harvesting, and marketing research program was established to conduct research on the harvesting, processing, and marketing of latent marine fishery resources in the gulf coast area and products from land-based aquaculture production, particularly products from catfish. We also partnered, and I hesitate to mention, with an operation up at Ole Miss, the University Physical Acoustics Laboratory. But, we have had an excellent relationship and they are addressing a very important problem in developing reliable fish population density estimates and we are working very closely with them in this area.

Less well known of the extensive research programs involving our current coastal research and extension activities, some that you will hear more about later, we have partnerships here with the National Marine Fisheries Service, Corps of Engineers, Mississippi Power Co., and many others.

Most importantly, Mr. Chairman, I thank you for the support you and the Congress have provided for our programs. Without it, none of this would have been possible. We thank you very much.

PREPARED STATEMENT

Senator COCHRAN. Thank you, Dr. Hurt for your comments. We appreciate your participation in this hearing today and your contribution to our understanding of the problems that need to be addressed in our research, specifically by special grants and other federally funded research.

[The statement follows:]

PREPARED STATEMENT OF DR. VERNER G. HURT

Senator Cochran, other members of this distinguished panel, I am Verner G. Hurt, Director of the Mississippi Agricultural and Forestry Experiment Station, Mississippi State University (MAFES/MSU).

I appreciate the opportunity to appear before you today to give you brief overviews of the importance of aquaculture to Mississippi and the programs of research we have at MAFES/MSU to support this growing and developing industry.

Your presence here today affirms your recognition of the major importance of Mississippi in providing food and other products from marine and freshwater production systems. Our gulf coast seafood industry has a long history of being a major supplier to our nation of products harvested from the Gulf of Mexico and more recently, other similar environments world-wide. Our domestic aquaculture industry is filling an equally important and even more unique role in the State.

Aquaculture is one of the fastest growing segments of U.S. agriculture and nowhere is this more evident than in Mississippi. Mississippi ranks number one in the United States in catfish production. In 1994, the farm value of catfish in Mississippi was more than \$250 million with an overall economic impact of more than \$2 billion because so much of the upstream impact (purchasing of input supplies and services) and downstream impact (processing, transportation, and marketing) take place within the State. Mississippi is in a unique position, from the standpoints of natural resources and climate, scientific and technical expertise, and commercial infrastructure, to capitalize on the growing demand for aquacultural products. These positive attributes provided the incentive and support for State and federal sponsorship of research programs which focus the efforts of numerous scientists dealing with production and culture of farm raised catfish and other species.

The contributions of MAFES/MSU to research supporting the growth and development of Warmwater Aquaculture are recognized world-wide. Certainly, these contributions have been enhanced by the partnerships between MAFES/MSU and other organizations such as the Cooperative State Research, Education, and Extension Service, the Agricultural Research Service, and the Agricultural Marketing Service of the U.S. Department of Agriculture (CSREES/USDA, ARS/USDA, and AMS/USDA). Catfish research programs were first initiated at the main campus and at

the Delta Branch Experiment Station (DBES/MAFES/MSU) at Stoneville with funding from a special grant through CSRS/USDA.

More recently the National Warmwater Research Center at Stoneville was established as a partnership between MAFES/MSU and ARS/USDA. Construction of 141 research ponds and a supporting aquaria facility is completed, and research is underway in these facilities. Construction will begin shortly on the office/laboratory facility, and additional staff support is being recruited. When completed, the National Warmwater Aquaculture Research Center will be the premier research facility of its type in the world.

Funds for the Stoneville Aquacultural Research Program (a partnership with CSREES/USDA) together with funds received through the National Warmwater Aquacultural Research Center, underwrite a major effort dedicated to water quality, catfish nutrition, and related areas. Commercial catfish feeds currently being produced are of high quality and incorporate the latest information on nutrient and energy requirements for rapid growth and efficient feed conversion. Although dramatic improvements in catfish feeds are unlikely, continued refinement of these feeds can lead to reductions in feed costs since feed costs make up approximately one-half of the variable production costs, with proteins and supplemental vitamins being the most costly components. Continued emphasis is needed on dietary protein requirements, protein/energy relationships, and stability of B-complex vitamins during the feed manufacturing process. Research in this area is enhanced by our partnership with one of the major feed mills in the area and with other private interests.

Catfish off-flavor is identified as the most serious problem in the commercial catfish industry. At present there are no reliable methods available to prevent off-flavor episodes in fish ponds. That is, neither reliable preventative measures nor methods to predict and control or abate off-flavor episodes have been developed. However, scientists have correlated the occurrence of certain species of blue-green algae with off-flavor episodes and we now have the predominant algae species in continuous culture. Thus, we expect to achieve a rapid increase in our knowledge of the critical biological and physical factors that affect growth, metabolism, and production of odorous compounds. This knowledge is the first requisite for development of technologies that will allow us to manage the off-flavor problem. A current joint effort with the College of Veterinary Medicine and industry is evaluating the efficiency and safety of diuron as a control for blue-green algae.

MAFES/MSU is also partnering with ARS/USDA and CVM/MSU on food safety research focusing upon catfish. The CVM/MSU is the only College of Veterinary Medicine with a program on fish health and fish diseases.

The Mississippi Center for Food Safety and Post-Harvest Technology is dedicated to the development of technologies related to catfish products. Scientists have significantly increased our understanding of perceived food safety issues related to the industry. Several areas of research currently underway are focused on the use of antimicrobial agents in processing plants, early detection and prevention of the occurrence of human pathogens in or on finished products, rapid screening tests for antibiotic residues in finished products, and packaging and extended shelf-life of products.

Technologies developed from this program will (1) allow us to avoid the occurrence of food-related health risks associated with contamination of foodstuffs irrespective of their points of sale and consumption, and (2) enhance our ability to capture the value added from further processing of our traditional raw agricultural products.

The aquaculture research program of MAFES/MSU also addresses problems in harvesting, processing, and marketing of catfish and other species and the production of alternative species including fresh-water shrimp, crawfish, and hybrid striped bass.

The MAFES seafood and aquaculture processing, harvesting, and marketing research program was established to conduct research on harvesting, processing, and marketing of latent marine fishery resources in the Gulf Coast area and products from land-based aquacultural production, particularly products from catfish.

We've also partnered with the University of Mississippi Physical Acoustics Laboratory in research to develop reliable fish population density estimates utilizing advanced acoustical technologies.

Less well known and extensive are the MAFES/MSU research programs involving the Coastal Research and Extension Center that you will hear more about from Dr. David Veal and his staff. These programs are extremely important to providing food science research support to both the marine and fresh-water fish industries, other research as it relates to the land-based culture of selected marine and fresh-water species, efforts to find ways to utilize under-utilized species in the Gulf of Mexico and to provide better management of our coastal-zone resources. The success of

these programs has resulted from partnerships with the National Marine Fisheries Service, Corps of Engineers, Mississippi Power Company, and many others.

Thank you for the opportunity to appear before you and for your support. None of these programs would have been possible without the support of Congress.

STATEMENT OF DR. HIRAM PALMERTREE, PH.D., DIRECTOR OF THE COOPERATIVE EXTENSION SERVICE, MISSISSIPPI STATE UNIVERSITY

Senator COCHRAN. Dr. Palmertree.

Dr. PALMERTREE. Thank you Senator Cochran. We certainly appreciate this opportunity. We certainly appreciate the committee staffers and also Dr. Veal's staff for assisting us here today and helping us with our federally funded extension programs.

I do appreciate talking with the representatives in the Extension Service and today, just in a couple of minutes, I will give you an overview of the Federal portion of our Extension progress.

To help to do this, I think your staffers already have a copy of a briefing book and certainly copies are available here. I will just briefly tell you what is here, your staffers have a copy. Under tab A in this briefing book is the executive summary, that is the same summary that was faxed to your office last week for the official reading papers and the official testimony. That is the same as the executive summary.

As you know the Extension Service is a quasi-USDA agency. We have a unique partnership with Federal, State, and county governments through the land-grant system of Mississippi State University.

Just briefly let me look in the book. We won't go into it in detail because your staffers have a copy and we will certainly respond later to any questions or comments they might have. But under tab B, we have given the Federal budget as it relates to the State budget and the county budget as a source of funds for the Extension Service. Now, in that budget, we do come to Congress each year from the Federal Extension System for base programs and 15 line-item programs. This also your tab B. The Mississippi Cooperative Extension Service participates not only in the base funding but in all 15 of those line items.

Now, under tab J, which is in the back of the book, our staffers have prepared an accountability summary. It is one page as to how we can be accountable for the funding under those 15 line items. But under tab, I believe it is I, we show accountability for our base programs. I understand Federal testimony before the Senate committee is May 29 on the request for the Federal Extension assistance for next year in which we are formally funded and block grant funded through those line items.

I just offer this for your use today and your staffers and will be glad to respond to any questions you might have as we go through the program.

Senator COCHRAN. Thank you very much. Dr. Veal.

STATEMENT OF DR. C. DAVID VEAL, HEAD, MISSISSIPPI STATE UNIVERSITY'S COASTAL RESEARCH AND EXTENSION CENTER

Dr. VEAL. I'm David Veal, head of the Mississippi State University's Coastal Research and Extension Center. It is indeed a pleasure for me to be here today and to be with my fellow staff members

to present an overview of our research programs being funded by Federal programs.

The Research and Extension Center is an administrative unit of a division of Agriculture at Mississippi State University that was created in the late 1980's to coordinate the activities of the Mississippi Agricultural and Forestry Experiment Station and the Mississippi Cooperative Extension Service.

I briefly stated that our mission is to conduct research and educational programs aimed at fostering the understanding and use of renewable and nonrenewable resources. It supplies research and educational programs, biological, physical, and social systems to focus on what to us is the most important aspect of our job and to improve the quality of life to residents of the State of Mississippi and other Gulf States.

In addition to that, we focus on applying the broad range of talent available through the State Land-Grant University, to problems that are unique to south Mississippi and to the upper gulf.

The Extension system is highly committed to working with local, State, and Federal agencies and a wide range of industries to develop secure funding for a broad range of research and educational programs. These programs are never undertaken without a complete understanding that this information must be done for the residents of south Mississippi and must have a positive impact on their quality of life.

The staff of the Research and Extension Center consists of about 45 professionals and a small number of support staff. Of these, about 30 are located in county extension offices and the remainder with our facilities and programs and Research and Extension Center as a whole.

Our research program falls into three general categories which you will hear more about today: (1) environmental awareness, including water quality and wetlands utilization; (2) fishery technology, which is associated with processing technology and waste disposal and utilization, fishing vessel gear development, fishery industry development, economics, and seafood safety and quality; and (3) aquaculture, including production and handling, product quality, and alternative species.

In addition to this research program focusing on these issues, the Research and Extension Center has county extension programs in the 12 southern counties which deal with the activities very typical of county extension programs elsewhere in the Nation including general agriculture, youth development, 4-H and consumer education and family economics as well as rural development.

Other programs with the Research and Extension Center include rural health care, horticulture, seafood processing and fishery development, economic development and family financial management, environmental awareness, and public policy.

Our research program, because of its ties to our land-grant university, is different from that of non-land-grant systems. Extensive ties with an industry clientele provides a keen awareness of industry needs, problems, and growth potential. This contact maintained by the Research and Extension Service professionals provides for real input. Our ability to identify research needs and priorities, secure funding and deliver that information through our continual

ties with the Cooperative Extension Service provides an ability that is unique to the land-grant system.

This successful interaction between industry and the land grant system is parallel to a higher development of a similar relationship with other States, local and Federal agencies. Examples of these directly affect the Research and Extension Center and are sent to our coastal aquaculture unit which has been developed by Mississippi State University and Mississippi Power Co. to support a variety of State, Federal, and private organizations. This facility is devoted to expanding the role of aquaculture in south Mississippi and to improve in the overall profitability of aquaculture in the industry.

In fact, one of the problems that you will hear discussed this morning by Dr. Mark LaSalle, and funded by USDA, focuses on a campaign of production of finfish aquaculture and utilizes created wetlands. Likewise, the development of the Surimi Seafood Processing Laboratory in Pascagoula is a joint effort of the Mississippi State University and National Marine Fisheries Service and National Fishing Service with support from the USDA. This facility is staffed by scientists for the Agricultural and Marketing Station, Mississippi Forestry and Extension Service, National Marine Fisheries Service, and the Department of Commerce Seafood Inspection Program.

This facility had allowed us to focus on the development of the broad range of fisheries, safety and quality problems. In addition to that, it has enabled us to focus on the development of unutilized species in the Gulf of Mexico.

You will hear in a few minutes Dr. Mike Jahncke and Dr. Doug Marshall further discuss those programs. Although not located at these two facilities, other staff will discuss more equally important diverse research issues. Ms. Cathy Holloman will discuss projects involving water quality. Mr. Dave Burrage will discuss issue development technology with primary focus on the existing fishing industry.

PREPARED STATEMENT

I submitted additional written comments to you. In the interest of time I will defer those and allow the staff to make a presentation.

Senator COCHRAN. Thank you very much Dr. Veal for that overview of the research activities.

[The statement follows:]

PREPARED STATEMENT OF DR. C. DAVID VEAL

Senator Cochran and other members of the distinguished panel—I am David Veal, Head of Mississippi State University's Coastal Research and Extension Center. I appreciate the opportunity to appear before you today to give a brief overview of the research and educational programs of the Coastal Research and Extension Center. As you will see, our research and educational programs are conceived, developed, and conducted so that they have a positive impact on the quality of life of Mississippians and, in particular, those residents of South Mississippi.

The Coastal Research and Extension Center is an administrative unit of the Division of Agriculture of Mississippi State University. It was created in the late 1980's to coordinate the activities of the Mississippi Agricultural and Forestry Experiment Station and the Mississippi Cooperative Extension Service conducted in the lower twelve counties of South Mississippi.

The Coastal Research and Extension Center serves as Mississippi State University's "southern exposure" linking residents of South Mississippi, one of Mississippi's

major population centers, and Mississippi's Land Grant University, Mississippi State University. The Research and Extension Center's mission is to conduct research and educational programs aimed at fostering a better understanding and use of renewable and non-renewable resources in South Mississippi. Its applied research and educational programs on biological, physical, and social systems focus on enhancing the quality of life of residents of the state of Mississippi and other Gulf states. Its educational and outreach programs apply the talents of the state's Land Grant University to problems unique to South Mississippi and the Upper Gulf.

Through an extensive system of advisory committees, established in each county in the southern part of the state, and through input from local, state, and federal agencies as well as from a broad range of industry organizations, the Research and Extension Center develops and secures funding for research projects primarily focusing on a better understanding and use of our renewable natural resources. These research programs are never undertaken without an implicit understanding that this information must be beneficial for the residents of South Mississippi and must have a positive impact on their quality of life.

The staff of the Research and Extension Center consists of approximately forty-five professionals and a smaller number of support staff. Of these professionals, approximately thirty are located in county extension offices in each of the twelve southern counties with the remainder located at research facilities or the central office of the Research and Extension Center.

Physical facilities of the Research and Extension Center consist of:

(1) Coastal Aquaculture Unit—An aquaculture research facility located in Gulfport, Mississippi on property owned by Mississippi Power Company. It is supported by government and private funds.

(2) Experimental Seafood Processing Laboratory, Pascagoula, Mississippi—This facility constructed by Mississippi State University's Agriculture and Forestry Experiment Station is jointly staffed by representatives of the Agriculture and Forestry Experiment Station, the Mississippi Cooperative Extension Service, and National Marine Fisheries Service. It is among the best equipped seafood research laboratories in the South, and its unique staffing makes it an important asset in fostering expansion of the fisheries industry in Mississippi and in ensuring the safety and quality of fishery products, although its work is not solely focused on fisheries.

(3) Other staff members are located at the central office of the Coastal Research and Extension Center in Biloxi or at Stennis Space Center.

The research program of the Coastal Research and Extension Center falls into three general areas of environmental awareness, fisheries technology, and aquaculture. A more detailed breakdown of these major research groupings is listed below:

Environmental Awareness

- Water Quality

- Wetlands Utilization

Fishery Technology

- Seafood Processing Technology

- Seafood Waste Disposal

- Fishing Vessel Gear Development

- Economics

- Seafood Safety and Quality

Aquaculture

- Production Enhancement

- Product Quality

- Alternative Species

In addition to a research program focusing on the above issues, the Coastal Research and Extension Center maintains an on-going informal educational program in a wide variety of areas all of which directly affect the quality of life of citizens of South Mississippi. In addition to the educational programs generally undertaken by extension service agents around the nation dealing with general agricultural, youth development and 4-H, and Family and Consumer Education, the Coastal Research and Extension Center has additional in:

- Rural Health Care

- Horticulture

- Seafood Processing and Fishery Development

- Economics and Economic Development

- Family Financial Management

- Environmental Awareness

- Recreational Industry Development

- Public Policy

and a wide variety of other issues.

The research program of the Coastal Research and Extension Center, because of its ties to a Land Grant University, is dramatically different from that of programs at non-Land Grant systems. Our research program is need driven. Extensive ties with industry clientele provide us with a keen awareness of industry needs, problems, and growth potential. This contact maintained by the researcher and by Extension Service's professionals provides for real-time industry input. The ability to identify research needs and priorities, secure funding, perform research and to deliver that information along with information from other sources is an ability unique to the Land Grant system. The success of this interaction between industry and the Land Grant system is paralleled by a similar cooperative relationship with local, state, and federal agencies. As an example, the research facilities of the Coastal Research and Extension Center reflect this common involvement of industry and multiple agency support.

Mississippi State University's Coastal Aquaculture Unit has been developed cooperatively by Mississippi Power Company and Mississippi State University with support from a variety of state, federal, and private organizations. This facility is devoted to expanding the role of aquaculture in South Mississippi and to improving the overall profitability of aquaculture as an industry. In addition to work with catfish, this nation's most successful aquaculture venture, the facility has conducted research on a variety of other non-traditional species and has focused on the relationship between aquaculture production and environmental issues. In fact, one of the projects you will hear discussed later by Dr. Mark LaSalle focuses on enhancing the production of finfish in pond culture utilizing created wetlands.

Likewise, the development of the Experimental Seafood Processing Laboratory in Pascagoula is a joint effort of National Marine Fisheries Service and Mississippi State University with support from U.S.D.A. The facility is jointly staffed by scientists from the Mississippi Agricultural and Forestry Experiment Station, Mississippi Cooperative Extension Service, National Marine Fisheries Service, and the Department of Commerce's Seafood Inspection Program. The establishment of this facility has allowed us to focus on development of underutilized species in the Gulf of Mexico, especially the coastal herring complex and the utilization of by-products from the existing catfish industry.

Although not located at either of the above-two facilities, other staff of the Research and Extension Center will discuss equally important but more diverse research and extension programs. Ms. Cathy Hollomon will discuss several projects involving water quality and water quality enhancement, and Mr. Dave Burrage will discuss fisheries technology with a primary focus on the existing commercial fishing industry.

The last comprehensive analysis performed on the seafood industry indicated that, in 1991, the seafood industry had a total direct, indirect, and induced output effect of approximately five hundred million dollars. Income effects during that same year were approximately two hundred and sixty million dollars. Total direct, indirect, and induced employment created by the seafood industry was approximately twenty-seven thousand man-years, a number much greater than most people would expect. Direct, indirect, and induced employment in the harvesting, processing and wholesaling sectors of the seafood industry alone were approximately eleven thousand man-years with most of that occurring in South Mississippi. The seafood industry in Mississippi, contrary to popular opinion, is not a dead or dying industry but employs more people, generates more income, and processes more product than at any time in the history of the industry. However, it is not without its problems, most of which are related to management of resources and not to the resource themselves. Most of the problems associated with the industry involve over-capitalization of either the harvesting or percent processing sector or both.

Almost without exception, Gulfwide the seafood industry can be categorized into the shrimp industry, the shellfish industry which includes oysters and related species, the edible finfish industry, and the industrial finfish industry. Most of the bulk of the harvesting in the Gulf occurs in the industrial fish industry while most of the value and employment occurs in the other industries with the predominant value and employment occurring with the Gulf shrimp industry.

Very little opportunity exists in traditional seafood industries for expansion. However, significant quantities of some underutilized species exist in the Gulf. The coastal herring complex consists of more than a dozen fish species occurring in the deeper waters of the Gulf. These individual animals are, in general, not suitable for use in the existing industry since they are not large enough for direct consumption and tend to be oily and dark fleshed. Some estimates of the abundance for this resource indicate that the annual quantity available for landings significantly exceeds the total quantity of all species currently landed in the Gulf. Exploitation of this resource could have a significant local and regional economic impact. We must con-

tinue to explore harvesting and onboard handling techniques, work that is being conducted by the National Marine Fisheries Service along with product development, particularly through analog forms. This work is funded by U.S.D.A. through a seafood and aquaculture processing, harvesting and marketing research program, and is currently underway at our Experimental Seafood Laboratory. Dr. Mike Jahncke and Dr. Doug Marshall will discuss the opportunities and the impact of full exploitation of these industries and related research.

SUMMARY

I believe that, individually and collectively, the research and extension initiatives you will hear discussed today will have a beneficial impact on the quality of life of Mississippians, particularly those in South Mississippi. The potential for expanding the economy, and improving our environment, and maximizing the sustainable utilization of our existing renewable natural resources is an attainable goal. The completion of each research and extension project undertaken by the Coastal Research and Extension Center moves us closer to this goal.

STATEMENT OF DR. MARK W. LASALLE, MARINE RESOURCE SPECIALIST, MISSISSIPPI STATE UNIVERSITY COASTAL RESEARCH AND EXTENSION CENTER

Senator COCHRAN. Dr. LaSalle.

Dr. LASALLE. Thank you Senator Cochran. We have a couple of visuals to help explain our program as we go through it this morning. It is my extreme pleasure to be here this morning, as I said. My name is Dr. Mark W. LaSalle. I work here on the coast in the Coastal Research Center. It is my pleasure to explain to you this morning a couple of the important projects that we have in the area we call our coastal wetlands program. As we know from these discussions, the program, as many of these projects, is aimed to have an impact to a significant contribution to both habitat protection and utilization. And, as it applies to our center, our efforts are to address these issues based on an approach that seeks to balance habitat protection and habitat utilization.

One of the first slides I would like you to see is how a wetland looks using the method funded through the U.S. Corps of Engineers through the USDA. We are in the fourth year now. We are trying to develop an easily applied method that is technically sound and objective in determining the relative functional quality of tidal wetlands. This is being conducted through a team of scientists from throughout the United States. We have representatives from all three coasts.

What we are trying to do is come up with an objective way of addressing the functional assessment of wetlands. Not only objectives, but also needs. The existing methods that we have in assessing wetlands historically have not provided an adequate means by which sound and defensible decisions can be made regarding wetland issues and provide qualitative ways of assessing functional and product enhancement. This is important because of the basic issue of wetlands, if I want to say something about tradeoff and how good a certain wetland is as opposed to the other, we have been unable to do that.

Another problem with those methods are twofold. One function or another and because some functions are more important than others, that creates problems.

What we are trying to do is develop a method that addresses multifunction and, as I said before, provides quantitative measures in a multiple functional capacity. It recognizes regional differences

in wetlands because they are different. They are not all the same everywhere.

These methods can also be used in a number of important ways to assess the important wetlands issues that include determining habitat problems such as mitigation. The major objective of this research was the evaluation of the key biotic functions provided by tidal wetlands constructed as mitigation for development and comparison of the characteristics of this site with that of natural tidal marshes.

These methods are exciting, as in our case. We hope to be very soon going out and actually testing and trying these methods.

A very close-related problem that speaks of mitigation issues is the project entitled "Evaluating the Functional Level of Created Marshes." It is also a part of the previously mentioned Corps of Engineers wetlands research program and was also funded by the USDA. Its main objective was to prepare an impartial value function of constructive wetlands.

These are projects that have been discussed a number of years now. We are still not aware of how well these newly created habitats compare to natural habitats. The main objective here is to do that. We also want to evaluate some of these construction techniques which also tend to be somewhat contrary at this time.

In this particular case that I am showing you this morning, this particular wetland was created by grading down the buffer zone. We also maintain that the unique aspect of this project was to do several unique designs in construction that were put there hoping to enhance its function, including the construction of concrete foundations.

Many of the functions that we studied here include a wide range. It is parallel to projects I mentioned too. We want to make sure we address all of these functions, including those important to estuaries. Here, we see the important fisheries as well as others. Some are somewhat less recognized as important, but nevertheless are. Fish of particular interest, particularly some of the ones that are not involved here but economically important species such as shrimp, we are also going to focus on.

We also took the opportunity to test and investigate some rather unique methods for evaluating some of these components. This structure is designed to estimate quantitatively shrimp populations and fish populations in the marshes.

Basically, this was a breakdown method that we used in part. We tested whether or not this particular methodology was able to re-create what would be naturally available. I want to point out that there is a centrally located design feature there that allows a change in water going into it.

This particular project was conducted on a Chevron site in Mississippi. They were gracious enough to allow us to do the project on their site.

Some of the results and benefits of this project include construction to see what the wetland does and if it has achieved the comparable function of natural wetlands. We studied it 9 years after it was constructed; many of the techniques, including the breakdown for allowing the success of those things, particularly some of

the unique design features that they employ, and we can hopefully use in the future.

A third and somewhat exciting project that I would like to talk to you a little bit about is the use of constructed wetlands as biological filters in aquaculture. The project is entitled "Use of Constructed Wetlands to Improve Water Quality in Finfish Pond Culture" and is being funded through the USDA's competitive grant program. It improves water quality in finfish pond culture, in particular displaced fish that are going to be in-pond that would normally be in that water. And, because of that, we do incur a lot of water quality problems. By circulating pond water through constructed wetlands, it is hoped that these problems can be reduced or eliminated, and if successful, allow for increased stocking densities and associated production levels.

We are also trying to determine the optimum design technology and also trying to determine the economic overall benefits. This technology cannot be utilized unless you have good information and can determine how it affects the bottom line.

By using constructed wetlands and using native plants when available, what we try to do is circulate water through these wetlands to treat water and improve the water quality there. And as I said, reduce the risk to production normally associated with fish kills within this pond. Preliminary results of particularly phase I, and we have noticed with phase II, illustrate that water quality is improving with conventionally large volume filters. The reduction in the risk to production is obvious. Hopefully by improving water quality, the fish in the pond will not have problems. We are also in phase II right now trying to assess that. We have also been recently notified of additional funding from the U.S. Department of Commerce for expanded work in this area.

We are also attempting to evaluate whether or not improved water quality reduces some of the problems that are related to fish is related to water problems. We improve that water quality and reduce some of the problems.

We also allow, as I said, increased production and we are now trying to document it. And another vantage point is that we normally produce effluents from these facilities. In the past, we have done this when the water quality is poor, the pond is usually pumped out. Circulated water in these ponds has eliminated that problem.

I might also add at this point that the Department of Commerce has indicated to us that they are willing to fund some added and additional work. Our aquaculture facility I might add, is addressing those other issues, in this case, catfish. This, as you know, is an important species in the delta portion of the State of Mississippi. We have also conducted research for a number of other species such as hybrid striped bass, freshwater prawns, redbass, and a number of alternative aquaculture species. These efforts have focused on demonstrating and evaluating the feasibility of pond production of these organisms.

I would like to mention a couple of others. We are active in a number of other research areas in the United States. I just want to mention a few to you mainly to demonstrate to you that we do

address a wider range of issues and do, as Dr. Veal mentioned to you, use a lot of other sources of funding for research.

I further would like to mention the Wetlands and Conservation Project that is helping to protect our national seashore as part of the U.S. Park Service, to help them to manage their facility better. We are also excited about an attempt to establish what we call the Mississippi Natural Estuarine Research Reserve Facility that is sponsored through the Department of Natural Resources of the State in partnership with Chevron U.S.A. and will be a partnership with a number of other State facilities in Mississippi. It will be a facility that will be utilized by a number of folks here in Mississippi and will develop the enormous value of the partnership of the local, State, and Federal Government.

Last, this is another indication of research in evaluating the shoreline restoration project for Chevron U.S.A. that provided a demonstration project that provided techniques to protect the shorelines.

And, of course, our job here at the Coastal Research Center is to transmit that information that we learn from that research to the users by our extension and public education programs and unique, I might add, because they are on the cutting edge of some of the things we do. The first part of our mission is that we are teaching folks that will be utilizing those measures exactly how to do that. We have also established what we call a Realtor's Communication Program. We think it is probably one of the only kind we know of in existence. It is a continuing education program for realtors and developers, sponsored by the Extension Service and a local realty association, that explains important aspects of wetland issues that affect their profession.

As Ms. Hollomon will talk to you about, we have expanded that into other areas as well.

We also do a coastal wetlands diversity workshop teaching that is sponsored by Chevron, a very good industry to Mississippi. And last, we have recently toyed with what we think to be the only program of its kind, an Environmental Explorer Program though the Boy Scouts of America where we teach young men and women and introduce them to career opportunities in the environmental field.

PREPARED STATEMENT

Thanks very much for the opportunity to explain the program to you and thanks for coming out here.

Senator COCHRAN. Thank you Dr. LaSalle for your interesting testimony and comments.

[The statement follows:]

PREPARED STATEMENT OF DR. MARK W. LASALLE

Good morning Senator Cochran and other members of this distinguished panel, my name is Mark W. LaSalle and I am a marine resource specialist with the Mississippi State University's Coastal Research and Extension Center, located here in Biloxi, Mississippi. It is my pleasure to have the opportunity to highlight for you some of the research efforts that we at the Center have been conducting regarding coastal wetlands. As you will note from these discussions, the results of these projects have practical applications for issues ranging from habitat protection to some of the exciting new practical uses of wetlands for addressing important human problems. Our efforts to address these issues, are based on an approach that seeks to balance habitat protection and habitat utilization.

The first project that I would like to mention involves an effort to develop a comprehensive technically-based method for evaluating the major ecological functions of tidal marshes. The "Tidal Wetland Functional Assessment Method" is being developed as part of the U.S. Army Corps of Engineer's Wetlands Research Program, and is being funded through the USDA. This method is being developed by a nine-member working group of estuarine marsh ecologists from throughout the U.S. The objective of this group is the development of an easily applied method that is technically sound and objective in determining the relative functional quality of tidal wetlands. This method will be of considerable use to scientists and engineers that are addressing regulatory issues such as determining habitat quality for wetland mitigation, assessing mitigation success, and assigning mitigation credits. Existing methods for judging habitat quality do not provide an adequate means by which sound and defensible decisions can be made regarding wetland issues. This method should provide them with a straightforward, objective, and technically-based means of making these important decisions that considers multiple functions provided by tidal wetlands and regional differences in these habitats.

The related issue of mitigation success of tidal wetlands is the major focus of the second project I would like to review for you. The project entitled "Evaluating the Functional Level of Created Marshes" is also part of the previously mentioned Corps of Engineers Wetlands Research Program, and was also funded through USDA. The major objective of this research was the evaluation of the key biotic functions provided by a tidal wetland constructed as mitigation for development and the comparison of the characteristics of this site with that of natural tidal marshes. This research also focused on the method of wetland construction that involved the grading-down of uplands and the construction of tidal creeks and elevational zones that were designed to improve the chances of successful mitigation. Following a two-year investigation of this constructed wetland, it appears that this marsh does provide comparable biotic functions to those of natural wetlands and that the methods used to construct the site and enhance its structure show promise for use in future mitigation projects.

One of our most exciting wetlands-related projects, however, is a study of the potential use of constructed wetlands as biological filters in aquaculture. The project is entitled "Use of Constructed Wetlands to Improve Water Quality in Finfish Pond Culture" and is being funded through the USDA's competitive grant program. The main objective of this research centers on the evaluation of the effectiveness of using constructed wetlands to improve the water quality in aquaculture ponds. Poor water quality in catfish production ponds can lead to the direct loss of fish and in many cases off-flavor problems in the harvested product. By circulating pond water through constructed wetlands, it is hoped that these problems can be reduced or eliminated, and if successful allow for increased stocking densities and associated production levels. Phase I of this project involved initial testing of a standard design for the pond-wetland system and evaluations of variations in the design factors such as wetland size and flow rates of water through the wetlands. Another key objective included the analysis of the economic costs versus benefits of using this technology. Preliminary results of this research showed that these pond-wetland systems are capable of improving water quality in ponds, and as an additional benefit reduce the release of nutrient-laden effluent into natural waterways. Phase II of this work is currently underway and includes continued evaluations of these designs at higher stocking densities of fish. We have also been recently notified of additional funding from the U.S. Department of Commerce/NOAA for expanded work in this area.

In addition to the work with catfish production and wetlands, our aquaculture research has also included efforts with hybrid striped bass, freshwater prawns, redfish, and a number of alternative aquaculture species. These efforts have focused on demonstrating and evaluating the feasibilities of pond production of these organisms.

Of course, these three projects are but a few of a variety of research efforts that the Coastal Research and Extension Center is conducting in coastal habitats and which are funded through a variety of sources. Other examples include:

- a U.S. Park Service-sponsored project involving the delineation and characterization of wetlands in the Davis Bayou Unit of the Gulf Islands National Seashore;
- the coordination of the State of Mississippi's effort to nominate and designation of a Mississippi National Estuarine Research Reserve System (NERRS), funding through the Mississippi Department of Marine Resources and DOC/NOAA; and
- the evaluation of a shoreline restoration effort funded by Chevron U.S.A.

Although research efforts add to our understanding of the issues being addressed, the dissemination of these results is also important, and is the goal of our extension efforts at the Coastal Research and Extension Center. And as with our research ef-

forts, our approach has been to provide a balanced view of wetland protection and utilization and includes some rather unique programs that target a diversity of audiences. Some of these programs include:

- participation in Corps-sponsored workshops designed to instruct regulatory personnel in the use and application of the newly developed approach toward assessing the functions of tidal wetlands;
- a continuing education program for realtors and developers, sponsored by the extension service and a local realty association, that explains important aspects of wetland issues that affect their profession;
- a continuing education workshop for teachers that introduces them to the diversity of wetland types and components, sponsored by Chevron, U.S.A.; and
- the joint sponsorship of an Environmental Explorer Program (Boy Scouts of America), that introduces area youth to environmental career opportunities.

I appreciate this opportunity to share this information with you and thank you for your support.

**STATEMENT OF CATHY Z. HOLLOWOMON, ENVIRONMENTAL SCIENTIST,
MISSISSIPPI STATE UNIVERSITY, COASTAL RESEARCH AND EXTENSION CENTER**

Senator COCHRAN. Ms. Hollomon.

Ms. HOLLOWOMON. My name is Ms. Cathy Hollomon, I'm an environmental scientist with the Mississippi State University Coastal Research Extension Center. My primary responsibility is to work on projects that address water quality issues within the Mississippi coastal zone. These projects focus on the pollution impact on coastal resources and how this impact affects the quality of life to Mississippi residents.

Nonpoint pollution is the type of pollution that enters our water bodies through surface runoff and through percolation of soil layers. This is opposed to point source pollution such as an outfall pipe. Point source pollution is currently controlled under the National NPDES Program which is administered by the Department of Environmental Quality. Nonpoint water pollution is controlled at this point and time.

The rest of the United States is just beginning to discover what Mississippians have known for a very long time in that this State provides a wide range of water-oriented resources and quite an enviable way of life. This is a strong attraction and, correspondingly, more and more people are moving to Mississippi from all over the country and are establishing businesses. This growth does, however, place a burden on the existing infrastructure of our community. Septic systems' ability are often strained and operate at or below capacity. Drains are altered or overburdened, exacerbating existing flooding problems downstream. All pollutants associated with traffic congestion are also increasing.

Because Mississippi is situated between two of the country's major drainage basins, the Mississippi and Tombigbee Rivers, we not only need to manage the nonpoint pollution problems that we generate locally, but also the pollution problems of everyone that lives upstream.

So one of the roles that we serve in the Coastal Research and Extension Center is to help citizens and local government focus their efforts on improving water quality in Mississippi and to work for offering simple solutions to these problems.

Today I will speak to you about the studies within our Coastal Water Quality Program. These studies attempt to define nonpoint source pollution problems and work toward offering potential solutions and I will be highlighting these studies.

"Evaluating Nonpoint Source Pollution From Failing Septic Systems in Coastal Mississippi"—this is a comprehensive study that assesses and evaluates nonpoint pollution from failing septic systems. Water contaminated by untreated or improperly treated sewerage can cause serious public health problems and can also cause harvesting prohibition to our shellfish harvesting area and in general prohibit activities on coastal Mississippi. The majority of septic systems that are installed in coastal Mississippi rely on underground absorption, even though the various soils that we have in Mississippi are unsuitable for performing this function. Consequently, a certain amount of untreated or partially treated sewerage enters our coastal waters.

The objective of this study is to assess and evaluate the septic system pollution throughout the Mississippi coastal waters, to recommend measures that can be taken by State and local authorities to minimize this type of pollution, and to develop a strategy for a team effort approach to this problem. To encourage interagency cooperation and a team approach to this problem, we developed a memorandum of understanding between the Mississippi State Department of Health and the Mississippi Department of Human Resources. To help foster this relationship further, we developed some training manuals, one for each of the departments, to help the departments cross-train their employees like the other departments, meeting responsibilities.

As the Mississippi coast continues to develop we need to manage the direct impact from the growth but also the cumulative and secondary impacts associated with growth. With this understanding, the benefits and results of these studies help improve oyster harvests, tourism, fisheries, and recreational activities by minimizing, and possibly eliminating, pollutants from untreated sewage to our coastal waters. By promoting interagency cooperation, coalitions among regulatory authorities are strengthened. In general, the overall management of nonpoint pollution is improved. This translates into a higher quality of living which in turn attracts industry, business, and tourism to Mississippi.

Another project that we are working on is the development of groundwork legislation sponsored by the Environmental Protection Agency, the Gulf of Mexico Program, and it responds to the need for consistent and comprehensive wastewater legislation throughout the gulf coast as far as trying to minimize the pollution damage, with all the States recognizing that if water quality is not maintained and if coastal resources are not managed, they will experience significant economic losses for the entire gulf.

The objectives of this project are simple and straightforward. First, with assistance from the Mississippi-Alabama Sea Grant Legal Program, we are developing model legislation for individual onsite wastewater disposal systems, anticipating that each State will be able to enact the legislation.

Second, we are developing educational materials for homeowners, business interests, and legislators. These materials consist of fact-sheets and a portable display booth. Upon completion of these studies, model legislation, containing wastewater criteria determined critical by regulatory authorities with the Gulf States, will be developed. If this legislation is adopted and implemented gulfwide, it

will provide comprehensive and consistent wastewater policies. The policy has significantly reduced the levels of pathogens, pollution entering our waters. The reduction has translated into an increase in oyster and commercial fishing and an overall improvement in the water quality which has made conditions better for everyone using the water, including our recreational activities as well.

The third project that we are working on, also sponsored by the Department of Commerce, investigates environmental impacts resulting from the casino industry. Many studies exist that describe the economic impacts of dockside gaming but little is known about the associated impacts to the natural and cultural environments.

Because casinos have sited in previously developed industrial sites causing relatively minor impacts to coastal resources, public concern has focused on the economic and moral issues associated with gambling. However, as these sites are used up, casinos are proposing to locate in more economically advantageous spots, specifically in more residential and sensitive wetland areas, and the public concern is now starting to shift toward the environmental issues.

The objectives of this study are to assess water quality impacts from dockside gaming facilities, specifically pollutants carried by stormwater during rain events. Second, to document the use of the best management practices to control and treat stormwater runoff, and to evaluate the effectiveness of existing stormwater management structures.

Understanding the impacts of water quality and coastal resources from nonpoint sources of pollution is imperative if we plan to manage the rapid growth currently being experienced along the Mississippi coast. Poor water quality would most certainly cause a decline in the numbers of tourists visiting our State and in the recreational and commercial fishing industries. It may also act as a deterrent in our area.

Other studies that we are conducting include a cooperative effort between the Mississippi and Alabama coastal zone management agencies involving nonpoint source pollution in the shared eastern section of the Mississippi Sound.

We also have an Environmental Protection Agency-sponsored project through the Gulf of Mexico Program to control the source of pollution responsible for oyster reef closures in the Bangs Lake/Point Aux Chenes Bay. In this study, we are monitoring the water quality as it passes through plant and rocks systems and within the downstream shellfish-growing waters.

In addition to research projects, we take an active role in educating people and distributing information about the causes, effects, and solutions of nonpoint source pollution through extension efforts. Some of our efforts include: developing educational factsheets that describe wastewater management options available for homeowners and the importance of proper operation and maintenance; conducting education programs for realtors that teach septic system options for home buyers and sellers, and how to comply with current regulations; producing factsheets and brochures to alert and educate at-risk consumers, such as people with compromised immune systems, of the potential harmful effects the bacteria *Vibrio vulnificus* can have if ingested while consuming raw oysters.

PREPARED STATEMENT

I think we can all agree that we have to maintain or even improve our water quality so future generations can enjoy Mississippi's vast resources as we do today.

Thank you very much for this opportunity.

Senator COCHRAN. Thank you very much Ms. Hollomon for your presentation.

[The statement follows:]

PREPARED STATEMENT OF CATHY Z. HOLLOMON

My name is Cathy Hollomon and I work as an Environmental Scientist with the Mississippi State University Coastal Research and Extension Center. My primary responsibility is working on projects that address water quality issues within the Mississippi Coastal Zone. These projects focus on nonpoint source pollution impacts to coastal resources and how they affect the livelihoods of coast residents and the overall quality of life enjoyed in Mississippi. Nonpoint source pollution is pollution that has no specific point of discharge, but is a diffuse flow entering waterways and groundwater reservoirs through surface runoff and percolation through soil layers. This is opposed to point source pollution that occurs at a single point or location such as an outfall pipe. Point source pollution is already controlled under the national NPDES program administered by the Mississippi Department of Environmental Quality. There are currently minimal controls for nonpoint pollution. The projects we work on include field investigations, public outreach and education programs, and literature reviews.

What the rest of the United States population is just starting to discover is what Mississippians have always known: this State offers a wonderful range of water-oriented resources and an enviable quality of life. This is a strong attraction, and correspondingly more people are making Mississippi their home, establishing new businesses and expanding existing industries. Growth does, however, place a burden on the infrastructure of our community. Sewage treatment facilities are strained, often operating above design capacity. Drainage patterns are altered and overburdened, exacerbating existing flooding problems. All pollutants associated with traffic congestion are also increasing. Because Mississippi is situated between two of the country's major drainage basins, the Mississippi and Tombigbee Rivers, we not only need to manage the nonpoint pollution problems that we generate locally, but also the pollution problems of everyone who lives upstream. One of the roles we serve at the Coastal Research and Extension Center is helping our citizens and local governments focus their efforts on preserving our water quality while at the same time encouraging Mississippi's growth.

Today I will be speaking to you about studies within our Coastal Water Quality Program. These studies attempt to help define nonpoint source pollution problems and work toward offering potential solutions. I will be highlighting three studies; two of them address the dominant types of nonpoint source pollution in coastal Mississippi, that is, failing septic systems and urban stormwater runoff, and the other is developing model legislation to help manage nonpoint source pollution gulfwide. The studies include Evaluating Nonpoint Source Pollution From Failing Septic Systems in Coastal Mississippi, Development of Framework Legislation, and Water Quality Impacts From Dockside Gaming Development. More detailed descriptions of each of these projects were forwarded to you previously for your review.

Evaluating Nonpoint Source Pollution From Failing Septic Systems in Coastal Mississippi, sponsored by the Department of Commerce/NOAA through the Coastal Zone Management Office of the Mississippi Department of Marine Resources—this is a comprehensive study that assesses and evaluates nonpoint source pollution from failing individual septic systems. Waters contaminated by failing septic systems can cause serious public health problems, beach closures, prohibitions on harvesting shellfish, and a loss of biological productivity in coastal habitats. The majority of septic systems installed in coastal Mississippi depend on underground absorption to treat and dispose of septic tank effluent even though the soils in coastal Mississippi are, in general, unsuitable for treating the effluent. Consequently, untreated sewage is entering our rivers, bayous, and nearshore waters, and contaminating shallow drinking water wells.

The objectives of this study were to: (1) assess and evaluate the extent of septic system pollution entering Mississippi's nearshore waters, (2) recommend management measures that can be taken by state and local authorities to minimize this

type of pollution, and (3) to develop a strategy for implementing the management measures. To encourage interagency cooperation and a team effort approach to this problem, a memorandum of understanding between the Mississippi Department of Marine Resources and the Mississippi State Department of Health was developed and is currently being negotiated. To help foster this relationship, two awareness training manuals were developed to educate and inform representatives of each agency about the duties and responsibilities of the other agency.

As the Mississippi coast continues to develop, we not only need to manage the direct impacts from growth but also the cumulative and secondary impacts associated with growth. Cumulative impacts refers to those impacts that when looked at individually seem minor but have significant consequences when taken collectively over a long period of time. Secondary impacts refer to the impacts caused not by the development activity itself, but by support or ancillary developments created as a result of the original activity. With this understanding, the benefits and results of these studies help to improve oyster harvests, tourism, fisheries, and recreational activities by minimizing and possibly eliminating pollutants from untreated sewage to our coastal waters. By promoting interagency cooperation, coalitions among regulatory authorities are strengthened. In general, the overall management of nonpoint source pollution is improved. This translates into a higher quality of living which in turn attracts business, industry, and tourism to Mississippi.

Another project, Development of Framework Legislation, sponsored by the Environmental Protection Agency—Gulf of Mexico Program, responds to the need for consistent and comprehensive wastewater legislation throughout the five gulf states. With two-thirds of the United States draining into the Gulf of Mexico, the gulf states, Texas, Louisiana, Mississippi, Alabama, and Florida, realize the significant economic losses that can occur if water quality is not maintained and if coastal resources are not managed in the best interests of the citizenry. Consequently, we are developing model legislation which, if adopted in each state, should help mitigate nonpoint pollution from improperly treated sewage from entering the Gulf of Mexico. We are developing this legislation in close cooperation with the wastewater regulatory authorities in each state. The legislation is intended to address individual on-site wastewater disposal systems only, not centralized collection and treatment facilities.

The objectives of this project are simple and straightforward. First, and with assistance from the Mississippi-Alabama Sea Grant Legal Program, we are developing model legislation for individual on-site wastewater disposal systems, anticipating that each state will be able to enact the legislation. Second, we are developing educational materials for homeowners, business interests, and legislators, etc. These materials consist of fact sheets and a portable display booth that uses text, pictures, schematics, and a working model to describe the problems and effects of inadequately functioning septic systems and explain solutions to the problem.

Upon completion of this study, model legislation containing wastewater criteria determined critical by regulatory authorities within the gulf states will be developed. If this legislation is adopted and implemented gulfwide, it will provide comprehensive and consistent wastewater policies. These policies will significantly reduce the levels of pathogens and nutrients entering our coastal waters. This reduction will translate into increases in oyster and commercial fisheries harvests and an overall improvement in water quality and safer conditions for recreational activities.

A third project also sponsored by the Department of Commerce/NOAA through the Mississippi Department of Marine Resources, titled Water Quality Impacts From Dockside Gaming, investigates environmental impacts resulting from the casino industry. Many studies exist that describe the economic impacts of the dockside gaming industry and few would argue that this industry hasn't brought an economic boom to Mississippi. But little is known about the associated impacts to the natural and cultural environments. Because casinos have sited in previously developed industrial sites causing relatively minor additional impacts to coastal resources, public concern has focused on the economic and moral issues associated with gambling. However, as these sites are used up, casinos are proposing to locate in more economically advantageous sites, specifically in more residential and sensitive wetland areas. As a result, public concern appears to be shifting toward environmental issues and preserving their quality of life and traditional lifestyles. In response, this study focuses on the methods and techniques that can prevent or minimize adverse effects of another type of nonpoint source pollution to our coastal waters, stormwater runoff.

The objectives of this study are to: (1) assess water quality impacts from dockside gaming facilities, specifically pollutants carried by stormwater during rain events, (2) document the use of best management practices to control and treat stormwater

runoff, and (3) evaluate the effectiveness of existing stormwater management structures.

Understanding and implementing proper stormwater management practices serves our community in a number of ways. Retaining stormwater and discharging it at pre-development flows prevents downstream flooding of residential and business communities. Providing primary treatment of pollutants minimizes contaminants that enter our coastal waters. Monitoring the water quality provides confidence for the safety and health of both tourists and coast residents.

Understanding the impacts to water quality and coastal resources from nonpoint sources of pollution is imperative if we plan to manage the rapid growth currently being experienced along the Mississippi coast. Poor water quality would most certainly cause a decline in the numbers of tourists visiting our state and in the recreational and commercial fisheries industries. It could also result in a migration of industry away from our state or a failure to attract new business and industry.

These three projects are just a sample of the studies within the water quality program currently being conducted by the Coastal Research and Extension Center. Other studies include:

- a cooperative effort between the Mississippi and Alabama coastal zone management agencies involving nonpoint source pollution in the shared eastern section of the Mississippi Sound, and
- an Environmental Protection Agency sponsored project through the Gulf of Mexico Program to control the source of pollution responsible for oyster reef closures in the Bangs Lake/Point Aux Chenes Bay. In this study, we are monitoring the water quality as it passes through plant/rock systems and within the downstream shellfish-growing waters.

In addition to research projects, we take an active role in educating people and distributing information about the causes, effects, and solutions of nonpoint source pollution through extension efforts. Some of our efforts include:

- developing educational fact sheets that describe wastewater management options available for homeowners and the importance of proper operation and maintenance.
- conducting continuing education programs for realtors that teach septic system options for home buyers and sellers, and how to compile with current regulations.
- producing fact sheets, brochures, etc. to alert and educate at-risk consumers, i.e. people with compromised immune systems, of the potential harmful effects the bacteria *Vibrio vulnificus* can have if ingested while consuming raw oysters.

I think we all agree that we have to maintain or even improve our water quality so future generations can enjoy Mississippi's vast resources as we do today. Thank you very much for this opportunity to share with you the projects we are involved with relating to our coastal water quality program.

EVALUATING NONPOINT SOURCE POLLUTION FROM FAILING SEPTIC SYSTEMS IN COASTAL MISSISSIPPI

Support: National Oceanic and Atmospheric Administration, Office of Coastal Resource Management through the Mississippi Department of Marine Resources (DMR).

Objectives: The primary objectives of this project are to:

- (1) Assess and evaluate the dominant source of nonpoint pollution in Mississippi's nearshore waters.
- (2) Recommend specific management measures, objectives, and guidelines for controlling septic system pollution.
- (3) Develop a strategy for implementing the management measures coastwide.
- (4) Draft a cooperative Memorandum of Understanding between the DMR and the MS State Department of Health (MSDH) to incorporate water quality and resource management considerations into existing programs.
- (5) Design and develop training manuals for the DMR and the MSDH to cross train field inspectors and initiate a united effort to minimize adverse impacts to Mississippi's coastal resources.

Description: Water quality data collected in Mississippi's nearshore waters after periods of heavy precipitation indicate that sewage pollution exceeds allowable limits in many bays and estuaries (Mississippi Department of Wildlife, Fisheries, and Parks 1992). Waters contaminated by failing on-site wastewater disposal systems can cause serious public health problems and an overall degradation of aquatic resources. Illnesses associated with septage contaminated drinking and ground water supplies include gastroenteritis, typhoid fever, dysentery, and infectious hepatitis. Various viruses are also known to be transported through improperly treated sew-

age. Other consequences of water quality degradation from sewage include beach closures, prohibitions on harvesting shellfish, and loss of biological productivity in coastal habitats.

This project was performed in two phases. Phase one described the various types of septic systems allowed by law in Mississippi,¹ the environmental parameters necessary for septic systems to operate properly, causes of system failure, an assessment of soil suitability, land use and population density distributions, and recommendations on how to minimize impacts to nearshore waters from failing septic systems. Phase two recommended management measures to minimize nonpoint source pollution from failing septic systems and developed a strategy to implement the management measures coastwide and to adopt stricter regulation at the county level. Awareness training manuals were developed for the DMR and the MSDH. Each agency will use the manual to educate their inspectors about the laws, responsibilities, and site assessment processes of the other agency. This coordinated, unified effort should help minimize adverse impacts to Mississippi's coastal resources.

Results: The most common type of septic system used in the coastal zone of Mississippi is the septic tank and absorption field. However, alternate methods including aerobic treatment plants, plant/rock filters, sand mounds, spray irrigation, and drip irrigation systems are also installed if conditions are determined to be acceptable by the County Environmentalist.

The two most critical environmental parameters that affect the performance of a septic system are soil type and texture, and ground water elevation. Soils must have the proper grain size and permeability to allow complete bacteriological breakdown of the effluent as it filters through the soil. Seasonally high water table elevations should be a minimum of two feet below the bottom of an absorption field.

Greater than 30 percent of each county has soils unsuitable for underground absorption. Still this type of system continues to be installed in these areas because State regulation does not have the necessary "teeth" to control system installation. Population densities are greatest within a few miles of the coast and within each of the county seats. Major population trends are around the Orange Grove area in Harrison County and along Hwy. 49 into Stone County. In Jackson County population growth is rapid in and around the Ocean Springs area and toward the East-Central communities.

Six management measures were recommended to minimize adverse impacts from malfunctioning septic systems. The measures address new and existing systems, existing regulation, public education and the need for centralized sewage collection and treatment. Implementation of these management measures require cooperative efforts between regulatory agencies, active outreach programs that educate and inform homeowners, legislators, businesses, etc., and public participation.

Critical to the implementation of the management measures is the development of a communications network. The network developed includes representatives from the Mississippi State Department of Health, Mississippi Department of Marine Resources, and the Mississippi Cooperative Extension Service. Sharing resources, personnel, and expertise is imperative to inform and educate legislators, boards of supervisors and the citizenry of the importance of proper wastewater management. Only when the severity of the problem is understood will support be realized to enact stricter regulation.

Benefits: As the Mississippi coast continues to develop, we are faced with an ever-increasing challenge of coping with the cumulative and secondary impacts of urban growth. By minimizing pollutants from sewage, oyster harvests, tourism, fisheries, recreation, and public health are improved. Information contained in this report will also result in direct and substantial improvements in efforts to manage nonpoint source pollution by:

- providing more complete data and analysis of the resource impacts of septic tank problems.
- improving protection of the ecological functions of coastal wetlands as well as providing better protection for areas contiguous to tidal wetlands.
- strengthening coalitions among coastal regulatory agencies.

DEVELOPMENT OF FRAMEWORK LEGISLATION

Support: Gulf of Mexico Program.

Objectives: The primary objectives of this study are to:

- (1) Develop model legislation for individual on-site wastewater disposal systems.

¹Allowed by law in Mississippi at the time of this project. Currently Mississippi has no wastewater law. It was repealed June 1995.

(2) Develop educational materials and outreach programs for individual homeowners, business interests, and legislators.

Description: Development of the model legislation was initiated by performing a comprehensive review of existing legislation and regulation within the five Gulf states. Similarities and differences between the various state statutes are being identified and gaps within the regulations or enforcement procedures are being determined. Several examples of legislation from other coastal states along the Atlantic and Pacific coasts are also being obtained and used in the analysis in an effort to incorporate other management strategies and techniques.

The final legislation developed will incorporate six criteria recognized by Gulf state health officials at a 1993 southeast regional meeting as being critical to prevent public health threats in nearshore waters and the degradation of biota in coastal areas. The six criteria include:

- Performing regular inspections, maintenance, and monitoring of all on-site disposal systems in regions that would directly impact shellfish harvesting areas.
- Requiring new homes and developments dependent on individual disposal systems to install water-saving plumbing fixtures.
- Requiring mandatory homeowner and home buyer education concerning on-site disposal systems.
- Establishing performance standards for on-site systems.
- Promoting strong enforcement of existing regulation and flexibility to utilize alternative systems where appropriate.
- Requiring permits to make repairs to on-site systems.

The educational needs of different groups of people (e.g., the general public, business, and legislators) are being considered during the development of educational materials that describe the problems, effects, and solutions for inadequately regulated septic systems in coastal areas. The needs of the people vary depending on a prior level of technical understanding and exposure to the subject matter. Therefore, a series of informational fact sheets and brochures are being developed, each targeted to a different aspect of the population (e.g., school children, homeowners, business leaders, legislators, etc.). Each fact sheet will incorporate graphics when and where applicable to aid in the understanding of concepts of operation or designs of on-site disposal systems. Topics to be addressed in the fact sheets include:

- How and why on-site disposal systems are effective treatment systems for sewage.
- Proper operation and maintenance of an on-site disposal system.
- Types of on-site disposal systems available (both conventional and alternative).
- Rules and regulations for on-site disposal system owners.
- What environmental conditions determine on-site disposal system suitability.

In addition, an easily portable display booth is being designed for use by citizen groups that show information on the problems, effects, and solutions for inadequately regulated on-site disposal systems in coastal areas. The display will include text, pictures, schematics, and models to explain the problems and solutions associated with on-site wastewater disposal systems. The effects and consequences of failing on-site systems on public health, nearshore and estuarine water quality and the marine environment, in general, is being included in the display. The importance of regulating the design and installation of on-site disposal systems is stressed.

Benefits: Upon completion of this study, model legislation containing critical wastewater criteria and reviewed by each state's wastewater regulatory authority will be developed. If the legislation is adopted and implemented gulfwide, it will provide comprehensive and consistent wastewater policies that significantly reduce nonpoint source pollution from on-site disposal systems and, consequently, the adverse impacts of bacterial and viral pollution to the marine resources within the Gulf of Mexico and the overall public health of the people living there.

WATER QUALITY IMPACTS FROM DOCKSIDE GAMING DEVELOPMENT

Support: National Oceanic and Atmospheric Administration, Office of Coastal Resource Management through the Mississippi Department of Marine Resources.

Objectives: The primary objectives of this study are to:

- (1) Assess potential nonpoint source water quality impacts to the Mississippi Sound from dockside gaming development.
- (2) Document the use of stormwater best management practices by dockside gaming facilities.

(3) Evaluate the effectiveness of the stormwater management structures installed at the casino development sites.

Description: The Mississippi Gulf Coast is experiencing unprecedented growth and development as a result of the legalization of dockside gaming. Multi-story parking

garages and hotels have replaced shrimp boat harbors, ice houses and processing plants. To date, the majority of existing casinos have sited in previously industrial areas resulting in relatively minor additional impacts to coastal resources. As these sites are used up, however, new casinos are proposing to locate in more economically advantageous areas, specifically in tracts of undeveloped land and sensitive wetlands areas. Public concern initially focused on the economic and moral issues associated with gambling. As casino complexes become more numerous and ubiquitous throughout Harrison and Hancock counties, public concern appears to be shifting towards environmental issues and preserving of the quality of life and traditional lifestyles characteristic the Gulf Coast.

Both Mississippi and Alabama benefit from the Mississippi Sound and its resources and, therefore, have vested interests in maintaining its quality. Consequently, the Coastal Zone Management agencies in both states have teamed together in a coordinated effort to evaluate the overall problem and to implement regional management strategies that mitigate potential adverse impacts to the shared resources of the Mississippi Sound. This project is part of a larger, more comprehensive study that is assessing the potential of nonpoint source pollutants to the east Mississippi Sound.

Several studies exist that describe the economic impacts of the dockside gaming industry but little is known about the associated impacts to the natural and cultural environments. This project investigates environmental impacts resulting from the casino industry. The purpose of this study is to evaluate and document the dominant types and sources of nonpoint pollution that result or may potentially result from the dockside gaming industry. Specifically, the methods and techniques that can prevent or minimize the adverse effects of stormwater runoff are investigated. It is not the intent of this study to collect additional data or monitor a given resource but to compile, review, and assess existing and available data and information. The focus of this study is on documenting water quality conditions pre- and post-dockside gaming and the use, or lack of use, of best management practices by the gaming facilities to minimize the degradation of water quality from stormwater runoff.

Stormwater runoff occurs when once pervious surfaces that allowed filtration of rainwater into the soil are paved, such as with the construction of parking lots, roadways, hotels, etc. This causes rainwater to sheetwash carrying pollutants such as oil, gas, grease, etc. into drainage ways, lakes, and the Mississippi Sound. Stormwater runoff, if properly managed and treated, should not increase flooding potential in downstream areas and should be a minimal threat to the resources of the Mississippi Sound. However, if stormwater runoff is not managed and treated properly, local flooding and water quality degradation within coastal waterways will increase.

This study was initiated with a comprehensive review of existing databases, local water sampling programs or monitoring efforts, and best management practices utilized for stormwater management. State regulatory agencies were contacted and coastal wetland permits and section 401 water quality certifications were reviewed to determine what actions, if any, are required of the applicant to manage the increased runoff from the development. Field investigations verified if stormwater best management practices were implemented as required at each casino development and made general evaluations to the maintenance and effectiveness of the practices.

Results and Benefits: Authority to regulate stormwater runoff is granted to the Mississippi Department of Environmental Quality. New developments with less than five acres of land disturbance do not require any form of stormwater management. If the development has greater than five acres of land disturbance, the first one-half inch of runoff must be temporarily ponded and treated on site. This management is only required during the construction phase of the project. However, if a wetland permit is required, stormwater best management practices are generally required in the water quality certification.

Basically four types of stormwater management practices are implemented by the casinos along the coast. These include: (1) grassed swales, (2) detention basins, (3) modular parking pavement, and (4) underground filtration systems. Grassed swales are the dominant form of stormwater management used. Grassed swales may provide sufficient runoff control to replace curb and gutter in single-family residential subdivisions and on highway medians but their effectiveness to manage stormwater runoff from large parking areas or control large storm events is limited.

Understanding the impacts to water quality and coastal resources from untreated stormwater runoff is imperative if we plan to manage the rapid growth currently being experienced along the Mississippi coast. Proper management of stormwater runoff helps prevent downstream flooding of residential and business areas and minimizes adverse impacts to water quality. Good water quality instills confidence

for the tourism industry and provides safe and healthy recreation for coast residents.

**STATEMENT OF DAVE D. BURRAGE, MARINE RESOURCES SPECIALIST,
MISSISSIPPI COOPERATIVE EXTENSION SERVICE/SEA GRANT AD-
VISORY SERVICE, MISSISSIPPI STATE UNIVERSITY COASTAL RE-
SEARCH AND EXTENSION CENTER**

Senator COCHRAN. Mr. Burrage, I think you are next.

Mr. BURRAGE. Thank you Senator. I'm a marine resources specialist with the Mississippi Cooperative Extension Service/Sea Grant Advisory Service and the Mississippi State University Coastal Research Center in Biloxi.

Our program's emphasis is on research information transfer to the Mississippi seafood industry, primarily the harvesting sector. Today I will provide a brief overview of three research projects that I manage to help the seafood industries in the Gulf of Mexico. These projects are supported by competitive grants and are summarized in more detail in your briefing packet.

The Mississippi seafood industry is a major contributor to the State's economy. The most recent figures available through the National Marine Fisheries Service said that in 1993, the profit added to the economy from the harvesting and processing sectors of the industry was about \$151 million. Those same two sectors of the industry generated about \$79 million of income tax in 1993.

Now, these figures do not include the additional economic activities generated by wholesale, retail, and restaurant sectors of the industry. We currently have about 2,200 full-time commercial fisherman in Mississippi that work out of ports in the three coastal counties. This number has dropped enormously in recent years due to a loss of shoreside support facilities as a result of dockside gaming development.

In 1994, Mississippi landed about 221 million pounds of seafood products with a dockside value of \$44 million. Although seafood landings in Mississippi are significant, the bulk of these activities are generated by processing centers. There are 32 processing plants and 22 wholesale operations in Mississippi. These plants employ about 1,300 people year around, with somewhat higher seasonal employment. Mississippi plants annually process about 50 million pounds of shrimp, 80 percent comes from other Gulf States or is imported. Now, to put that in perspective for you, 50 million pounds of shrimp is one-quarter of the total of domestic harvest in the United States. The processed value of the product is \$160 million each year.

The Mississippi seafood industry has experienced some problems, some of which are common to the industry in general and some of which are specific to Mississippi and the northern gulf region. Despite recent trends in seafood food consumption patterns by health-conscious consumers, seafood per capita consumption remains relatively flat at about 15 pounds for the last several years, well below chicken, beef, and pork. The United States lags significantly behind other countries of the world in seafood production.

Recent events, like the FDA proposal to ban oyster harvesting in the Gulf of Mexico during warmwater months over concern over *vibrio vulnificus*, made good press but did not do much for consumer confidence in seafood. But despite the negative press,

fishermen could not supply enough product from U.S. waters to meet demand, and shrimp is a good example.

As you heard this morning, about 75 percent of the shrimp in this country is imported. That contributes significantly to the \$5 billion trade deficit we have here in shrimp and seafood products.

One of the biggest problems the industry is going to be facing arises in the user group conflicts regarding the allocation of common property fishery resources. Net ban initiatives are being promulgated by recreational interests at an alarming rate and, as a result, many hard-working people have lost the ability to earn a living the only way they know how. And, U.S. seafood consumers are suffering too because they are denied access to the resource. With the coastal population projected to increase to 227 people per square mile by the year 2010, the resource problem is only going to get worse.

In order to provide an understanding of the way we at the Coastal Research and Extension Center/Sea Grant Advisory Service work to improve the quality of life for our fisherman, I am going to share with you the specifics about three ongoing projects which I am responsible for. Two of the projects concern the bycatch issue and the other one deals with the very real problem of marine pollution. You will notice that these are funded by the Environmental Protection Agency and the Department of Commerce. If it wasn't for the USDA funding I wouldn't be in a position to compete.

The broad objectives to my programming are to increase the understanding of how and how much bycatch occurs in all Gulf of Mexico fisheries, so that those in charge of fishery resources will be fair in developing any needed regulations. Two, to help coastal fisheries reduce their operating costs so that U.S. products will remain competitive in the world marketplace, and to improve environmental quality as well.

Now, while bycatch occurs in all fisheries, the bulk of it centers on shrimp trawl fisheries in the Gulf of Mexico. The most recent estimates by the National Marine Fisheries Service is that for every pound of shrimp caught in the gulf, 4 pounds of finfish are captured and killed. Now, this is far below the 10-to-1 ratio that we are hearing from the environmental groups and sports-fishing interests but still is a real perceived problem. The industry has been very cooperative in tackling this. Boat experts agree that the reason the current figures are much lower than the average is the mandate to use the turtle excluder devices, which reduce finfish catch as well as get rid of turtles in the nets.

Almost all the research to date has been on these large offshore vessels, ships that pull four large trawls. Observers on these vessels are evaluating bycatch reduction devices used in conjunction with TED's, which at least in theory get rid of fish while keeping shrimp. But a large portion of the fisheries is caught in shore waters by small boats that are limited by law to using small 25-foot nets. That fishery is largely overlooked by the researchers.

This is where we have concentrated our recent efforts. We cooperated with inshore fishermen to evaluate the performance of TED designs commonly used in the smaller inshore nets. We had hoped to provide fishermen with information regarding the catch performance so they may use the best device for their particular

operations. We also wanted to document the bycatch reduction and the shrimp retention characteristics so fishermen could get credit for TED use in the upcoming bycatch regulations for inshore waters.

And finally, we wanted to see if there was any fundamental difference in the species composition and the magnitude of bycatch and what has been observed in the offshore waters. Each of the five TED's pulled a minimum against what we called a naked net, that is a net without any gear in it whatsoever, no TED and no control. We checked and separated and evaluated using the protocol developed by the National Marine Fisheries Service and some of the results were quite interesting. For example, one of the designs we were able to get rid of, total catch, reduced total catch in the finfish catch by 30 and 42 percent, respectively, without any significant reduction in the shrimp catch. This type of information was passed on to other fishermen to help with their operations.

Coastal research in the Gulf of Mexico regarding bycatches concerns commercial shrimp fishing. However, many other fisheries, including recreational users in the gulf, also impact nontarget species. This is particularly true in light of the recent regulations regarding size and quotas. I served on a gulfwide panel to determine the extent of the bycatch problem in all fisheries of the gulf. I've cooperated with Texas A&M University, Auburn University, and the Gulf and South Atlantic Fisheries Development Foundation.

The gulf is an essentially closed circulation system. Things like marine debris and other pollution tend to float along with the currents until they eventually wash ashore. Within 3 hours on a single day, volunteers picked up 23 tons of garbage on Mississippi beaches. Of this, 53 percent was plastics. Besides being essentially displeasing, marine debris impacts wildlife when they mistake it for food. Plastic bags resemble jelly fish, a regular food for sea turtles. Marine debris also damages boats and motors and fishing gear. Commercial fishermen contribute to the problem either knowingly by tossing trash overboard or inadvertently by losing fishing gear.

Mississippi State University is taking the lead role in a gulfwide education program on the marine resources for the marine fisherman. As a group, commercial fishermen traditionally have been hard to target because of their educational level due to their transient nature and the fact that they spend so much time offshore making a living. So the Sea Grant Marine Advisory and Extension Network is being used to help reach fishermen at their national meetings and conventions. This provides more information to help reduce marine debris from its source.

In summary, the seafood industry in Mississippi has a good partner in the Coastal Research and Extension Center. Working together we can accomplish things we couldn't do alone. The decisive research we undertake has a direct and immediate benefit for our clientele group. The fact we just talked about the TED project, we all rely on our members and cooperating partners in our research to process and get information to people.

Thank you for your time.

PREPARED STATEMENT

Senator COCHRAN. Thank you for your interesting report, Mr. Burrage.

[The statement follows:]

PREPARED STATEMENT OF DAVID D. BURRAGE

My name is Dave Burrage. I am a marine resources specialist with Mississippi Cooperative Extension Service/Sea Grant Advisory Service and work out of Mississippi State University's Coastal Research and Extension Center in Biloxi, Mississippi. My programming emphasis is on research and information transfer assisting the Mississippi seafood industry, particularly the harvesting sector. Today I will provide a brief overview of Mississippi's seafood industry and show how three current fisheries-related projects I manage are designed to assist this vital portion of the economy in Mississippi and the northern Gulf of Mexico. These projects are supported by grants obtained through a competitive-funding procedure and are summarized in more detail in the briefing packet.

The Mississippi seafood industry is a major contributor to the state economy. The most recent figures available from the National Marine Fisheries Service (NMFS) show that in 1993, the harvesting and processing sectors of the industry pumped about \$151 million of value added into the state economy. The same two sectors of the industry generated about \$79 million in income effects in 1993. These figures do not include the additional economic activity generated by the wholesale, retail and restaurant sectors of the industry. There are currently about 2,200 full-time commercial fishermen working out of Mississippi ports in the three coastal counties. This number has dropped somewhat in recent years due to a loss of shoreside fleet support businesses in conjunction with dockside gaming development. In 1994, Mississippi commercial fishermen landed about 221 million pounds of seafood products with a dockside value of \$44 million. Although seafood landings in Mississippi are significant, the bulk of economic activity is generated by the processing sector. There are 32 processing plants and 22 wholesale operations in Mississippi. These plants employ about 1,300 people year-round, with somewhat higher seasonal employment. Mississippi plants annually process about 50 million pounds of shrimp, 80 percent of which comes from other Gulf states or is imported. Fifty million pounds is roughly one-fourth of the entire annual wild shrimp production in the Gulf of Mexico. The processed value of seafood produced in Mississippi averages about \$160 million each year.

The Mississippi seafood industry is experiencing problems, some of which are common to the industry in general, and some of which are specific to Mississippi and the Gulf of Mexico region. Despite recent trends in food consumption patterns by health-conscious consumers, seafood per capita consumption in the U.S. has remained relatively flat at about 15 pounds for the last several years. This is well below chicken, beef and pork. The U.S. lags well behind the rest of the world in per capita consumption of seafood. Recent events like the ADA proposal to ban all oyster harvest from the Gulf during warm-water months (due to concerns over *vibrio vulnificus*) made good press but didn't do much for consumer confidence in seafood. Despite the negative press, fishermen cannot supply enough product from U.S. waters to meet the demand for some species. Shrimp is a good example. About 75 percent of the shrimp consumed in this country is imported, contributing to the \$5 billion trade deficit the U.S. had for fishing products in 1994. One of the biggest problems the industry is currently facing arises from user-group conflicts regarding allocation of common property fishery resources. "Net ban" initiatives are being promulgated by recreational interests at an alarming rate. As a result, many hard-working people have lost the ability to earn a living the only way they know how, and U.S. seafood consumers are denied access to the resource. With the coastal population projected to increase to an average of 227 people per square mile by the year 2010, these types of conflicts between various user-groups competing for finite resources will become more prevalent.

In order to provide an understanding of the way we at the Coastal Research and Extension Center/Sea Grant Advisory Service work to improve the quality of life for our constituents, I will share with you some specifics about three ongoing projects I am responsible for. Two concern the "bycatch issue" and the other deals with the very real problem of marine pollution. The broad objectives of my current work with the seafood industry are to: (1) increase the understanding of how and how much bycatch occurs in all Gulf of Mexico fisheries, so that those charged with managing fishery resources will be fair in developing any needed regulations; (2) help commer-

cial fishermen reduce their operating costs so that U.S. products can remain competitive in the world marketplace; and (3) improve environmental quality in the Gulf of Mexico region. While bycatch occurs in all fisheries (including recreational), the bulk of recent attention has centered on the shrimp trawl fishery in the Gulf and South Atlantic Region. The most recent estimates by NMFS are that for every pound of shrimp produced in the Gulf four pounds of finfish are captured and killed. Although this is far below the "10 to 1" ratios currently being used as propaganda by environmental and sport fishing groups, this bycatch is a perceived problem which the industry has been proactive in tackling. Most experts agree that the reason current bycatch figures are lower is the mandated use of turtle excluder devices (TED's) which release finfish as well as turtles from the nets. Almost all of the research to date has been conducted aboard large offshore vessels which typically pull four large (40 feet and up) trawls. Observers on these vessels are also evaluating bycatch reduction devices (BRD's) used in conjunction with TED's which, in theory at least, help reduce finfish bycatch without adversely affecting shrimp production. A large amount of effort occurs in the inshore fishery aboard small boats which are limited by regulation to towing two twenty-five foot nets. This element of the fishery has largely been overlooked by researchers and is where we have concentrated our recent efforts. We cooperated with inshore fishermen to evaluate the performance of five TED designs commonly used in the smaller inshore nets. We hoped to provide fishermen with information regarding TED performance so that they can use the best device for their particular operations. We also wanted to document the bycatch reduction and shrimp retention characteristics of TED's so that fishermen could get "credit for TED" use in any forthcoming bycatch regulations for inshore waters. Finally, we wanted to see if there was any fundamental difference in species composition and magnitude of bycatch from what has been observed in the offshore fishery. Each of the five TED's was pulled a minimum of twenty tows against a "naked-net" (control net with no TED). The catches were separated and evaluated using protocol developed by NMFS for BRD evaluations. Some of the results were quite interesting. For example, one of the designs showed a reduction in total catch and finfish catch of 30 percent and 42 percent respectively with no significant loss in shrimp production. This type of information is then passed along to fishermen to help them reduce labor costs and increase shrimp production as well as reduce unwanted bycatch.

Most of the research in the Gulf of Mexico regarding bycatch has concerned the commercial shrimp fishery. However, many other fisheries and fishing gears used within the Gulf also impact nontarget species. This is particularly true in light of increasing regulations regarding size and creel limits, as well as commercial quotas. I am in charge of a Gulf-wide panel of experts tasked with determining the state of knowledge regarding bycatch in other fisheries such as pelagic and bottom longlines, commercial hook and line, purse seines, trap fisheries, gill and trammel nets, recreational hook and line, finfish trawls, and recreational shrimp trawls. Auburn University, Texas A&M University, and the Gulf and South Atlantic Fisheries Development Foundation are partners in this undertaking.

The Gulf of Mexico is a marine basin with essentially a closed circulation pattern. Marine debris and other forms of pollution tend to float along with the currents until eventually, they wash up on shore. Within 3 hours on a single day, volunteers picked up 23 tons of garbage on Mississippi beaches, 53 percent of which was plastics. Besides being aesthetically displeasing, marine debris can harm wildlife when it ensnares it, or is mistaken for food. Plastic bags resemble jellyfish—a favorite food of sea turtles. Marine debris also damages boats and motors and destroys fishing gear. Ironically, commercial fishermen contribute to the problem either knowingly by tossing trash overboard, or inadvertently when they lose fishing gear.

Mississippi State University has taken the lead role in developing a Gulf-wide educational program on marine debris for commercial fishermen. As a group, commercial fishermen have traditionally been hard to target for this type of educational effort due to their transient nature and the fact that they spend so much time on the water earning a living. The Sea Grant Marine Advisory/Extension network is being used to help reach fishermen at their annual meetings and conventions. This provides more "bang for the buck" in helping reduce marine debris from this source. The seafood industry in Mississippi has a good partner in the Coastal Research and Extension Center/Sea Grant Advisory Service. Working together, we can attain goals neither could reach alone.

COMMERCIAL FISHERMEN MARINE DEBRIS EDUCATION PROGRAM PROJECT DESCRIPTION

Funding Agency: United States Environmental Protection Agency/Gulf of Mexico Program

Project Status: Ongoing

Project Goals and Objectives: The general goals of this project are to (1) eliminate the illegal disposal and careless loss of man-made solid waste in marine and coastal environments of the Gulf of Mexico, (2) eliminate existing debris from the marine and coastal environments of the Gulf of Mexico, and (3) foster pride and stewardship and increase understanding of the marine and coastal resources of the Gulf of Mexico (including the harmful effects of marine debris) among the user groups of the Gulf of Mexico region. The specific objectives of this project are as follows:

1. To coordinate and secure the enactment of and compliance with federal, state, and local laws and regulations to prevent pollution by solid waste in the Gulf of Mexico from both land-based and offshore sources;

2. To implement the commercial fishermen program developed by the Texas General Land Office in each of the five Gulf states.

Identification of Problems: Garbage from merchant ships, commercial and recreational fishing vessels, cruise ships, and drilling platforms, plus debris from inland municipal sewage and waste disposal facilities that washes into the Gulf is a major problem. Because circulation within the Gulf is limited, solid waste and other pollutants float along with the currents until, eventually, they wash up on shore. Indestructible plastic waste tossed into the marine environment kills thousands of seabirds and marine mammals each year by entanglement or being mistaken for food. Many sea turtles die each year from eating plastic that looks like jellyfish, one of their favorite foods.

Within three hours on a single day in September 1991, volunteers picked up 18 tons of garbage on Alabama beaches, of which 57 percent was plastics. On both coasts of Florida, there were 180 tons of garbage, 60 percent plastics; in Louisiana, 133 tons, 68 percent plastics; in Mississippi, 23 tons, 53 percent plastics; and in Texas, 199 tons, 72 percent plastics. This debris came only from those beaches chosen as cleanup sites. However, more than a ton of trash per mile can be found on some Gulf beaches. In fact, three Gulf states exceeded the national average in terms of plastics as a percentage of marine debris collected.

Approach: The project is administered from Mississippi State University's Coastal Research and Extension Center (MSU/CREC), and covers the five Gulf states (Florida, Alabama, Mississippi, Louisiana, and Texas). In order to facilitate more thorough gulfwide coverage of the project, the responsibilities of the project partners are divided geographically as follows: Rick Wallace (Auburn University) is responsible for the state of Alabama and the Gulf coast of Florida; Dave Burrage (Principal Investigator, MSU/CREC) is responsible for the states of Mississippi, Louisiana and Texas. The non-Federal sources of funds and facilities used in the performance of the proposed project are provided by Mississippi State University and Auburn University. Project personnel use educational materials developed by the Texas General Land Office as a cornerstone to develop a comprehensive programming effort targeting commercial fishermen throughout the Gulf of Mexico. These materials include brochures, decals and videos in English, Spanish and Vietnamese.

Project personnel query Sea Grant agents and specialists in the five Gulf states to determine the number of copies of materials which are required to adequately reach commercial fishermen throughout the Gulf. Concurrently, a list of commercial fishermen organizations is developed and these organizations are contacted in order to determine membership size and scheduling of major annual meetings. Master copies of the materials developed by the Texas General Land Office are sent to MSU Information Services to assist in producing the requisite number of materials needed Gulf-wide as determined by the survey. Project personnel then forward materials to Sea Grant marine agents and specialists for distribution and travel to major meetings of commercial fishermen groups in order to make first-hand presentations regarding marine debris issues relevant to commercial fishing operations and further distribute program materials. The Information Services Department located on the main campus of Mississippi State University provides support in developing videos and printed matter used in the project. This department is responsible for developing and producing many of the educational materials used by Mississippi Sea Grant Advisory Service and its staff members are among the best in the country at what they do.

The Sea Grant Marine Advisory Service/Marine Extension Network is uniquely suited to assist with this project throughout its broad geographic coverage because Sea Grant marine agents and/or specialists are already located in or responsible for each coastal county or parish in every Gulf coast state. In addition to directly distributing program materials to their respective commercial fishing clientele groups, these agents and specialists serve as an excellent source of local knowledge regarding the commercial fishing organizations existing throughout the Gulf. Project per-

sonnel routinely network with these agents and specialists in various projects and subject matter areas to provide educational programming on a regional basis.

Project Results and Benefits (To Date): Project impacts are evaluated using a two-tiered approach: (1) Records are maintained relative to the geographic coverage and numerical distribution of program materials and presentations. (2) A survey of commercial fishermen who receive training through this project is conducted in order to document behavioral changes brought about as a result of the project. This information will be summarized in a final project report prepared by the principal investigator. Benefits developed under this project are widely transferable. These benefits include enhanced sustainability of fisheries, clean and safe beaches, reduction of damage to boats and gear, the reduction of the harmful effects of marine debris on wildlife and habitat, and development and utilization of recycling programs and adequate reception facilities.

INSHORE TED EVALUATION AND TECHNOLOGY TRANSFER PROJECT DESCRIPTION

Funding Agency: United States Department of Commerce/National Marine Fisheries Service

Project Status: Ongoing

Project Goals and Objectives: The major goals of this project are to (1) evaluate the shrimp retention and bycatch reduction characteristics of TED's designed for use in small inshore shrimp trawls and (2) train inshore fishermen to assist others throughout the northern Gulf in choosing, installing and using TED's correctly.

Identification of Problems: Inshore shrimp fishermen are still very low on the learning curve regarding proper TED installation and use. Inshore shrimping grounds tend to have more trash and natural debris on the bottom which clog TED's. As a result, shrimpers in the northern Gulf have reported catch losses ranging from 14 to 63 percent due to TED malfunctions. Clogging also disables the turtle exclusion capability of the devices. There is a need for trained individuals in the northern Gulf area to assist fishermen in adapting their harvest techniques to this technology. It has been shown that certain TED devices work better in different bottom conditions. Fishermen need to know which TED will work best for them given their particular circumstances. Subsequent to the implementation of TED regulations, new designs have been developed which show some promise for alleviating some of the aforementioned problems. Very little work has been done to document the shrimp retention and bycatch exclusion rates of TED designs used in small inshore shrimp trawls. Fishery managers and fishermen need more information about the shrimp retention and bycatch reduction characteristics of TED's available for use in the inshore fishery.

Otter trawls used to harvest shrimp in the Gulf of Mexico are inherently non-selective fishing gear. Estimates by the National Marine Fisheries Service (NMFS) indicate that in offshore waters of the Gulf of Mexico 1.1 billion pounds of finfish are taken incidental to shrimping operations annually. The total extent of shrimp trawl bycatch is largely unknown. The studies which do exist may or may not be representative of what is occurring in the fishery due to the seasons and areas in which they were performed. There is a notable gap in information regarding shrimp trawl bycatch in inshore waters where the fishery is managed by the various Gulf and South Atlantic states. Some of the non-target species captured in shrimp trawls are important in recreational fisheries and/or targeted in other commercial fishing operations. Of primary concern are those species for which management plans are in effect or being proposed.

Another major reason that TED regulations are still not being successfully adapted to by inshore fishermen is the lack of trained individuals to assist them in selecting, installing and utilizing TED's. One avenue of technology transfer which has proven to be very successful is the Sea Grant Advisory Network working closely with shrimpers, who in turn, help others. Unfortunately, the various Sea Grant Programs do not have the wherewithal to compensate shrimpers for the time devoted to helping their peers (and the concurrent loss of shrimping opportunities) without some form of financial assistance. The Endangered Species Act makes no allowances for those who suffer economic dislocation as a result of conservation and protection requirements contained therein. However, the potential benefits to all of society should not come about as a result of costs borne solely by the shrimp industry. While there are many fishermen with the expertise to develop inshore TED technology, few, if any, have the resources to develop new ideas on their own. Further, there needs to be a mechanism for preparing reports, diagrams, etc. and channeling this information to other members of the industry. This is beyond the capability of individual fishermen but well within the purview of the Sea Grant Advisory/Extension network. Shrimp fishermen as a rule do not possess the necessary mathemati-

cal and biological training to determine whether or not observed test results are statistically significant.

Scientific or Technical Objectives and Procedures: In order to obtain meaningful data, gear evaluations should be conducted under "real world" conditions (i.e. during times of the year and in locations where shrimping operations are normally conducted), and utilize the knowledge and expertise of professional fishermen. To persuade fishermen to participate in gear evaluations, some means of compensating them for lost production due to use of unfamiliar and unproven gear, shorter than normal tow times, and down-time due to experimental gear modifications must be available.

Project emphasis is directed toward testing and documenting the bycatch exclusion and shrimp retention rates of TED's designed for use in small inshore shrimp trawls. In order to achieve this objective, comparison testing using experimental and control nets is conducted on commercial shrimping grounds where and when the fishery is normally prosecuted. We are testing several TED designs during inshore shrimping operations in the northern Gulf of Mexico by comparing catch rates with control nets in twin-trawl configurations using 25-foot headrope nets. These are the most common nets used in the inshore fishery in the northern Gulf due to gear restrictions imposed by the various state resource management agencies. Data consist of weight measurements for total biomass, finfish and shrimp. Subsamples are taken and worked up for speciation, counts and weight. Shrimp catch rates and bycatch quantity and speciation are documented by the principal investigator.

In order to document the bycatch reduction associated with the various TED's which are used in this project, the control nets used in this work are "naked nets" which are identical in all respects to the experimental nets except for the presence of a TED. This involves obtaining an experimental gear permit from NMFS and the state resource management agencies with a concomitant reduction in tow duration. To help compensate the cooperating vessel owners for the reduction in production associated with abbreviated tow times, as well as downtime during gear changes, they are paid \$150 for each 24-hour period the P.I. and/or Gear Specialist is on the boat conducting the tests.

All TED's used for this study meet the certification criteria for turtle exclusion outlined in the TED regulations. The project emphasizes hard-grid TED's because they are the predominant gear being used by inshore shrimpers in the northern Gulf. Examples of TED's tested include the inshore and mid-size super shooters, the fixed-angle hoop TED, the square-bottom Anthony weedless TED, and the Chalmette zipper TED. Personnel from the NMFS-SEFC Pascagoula Facility Harvesting Technology Branch are asked to inspect, and in some cases, help install the various TED's used in the study in order to ensure they will work at optimum levels prior to actual on-the-water testing.

Each TED used in the experiments is pulled a minimum of 20 tows in order to generate enough data to be used for statistical analyses. The experimental and control nets are pulled from both sides of the vessel (positions swapped after 10 tows) in order to minimize any variations in door settings, bridle arrangements, try net influences and operational tendencies (for example, some captains always turn to starboard). Gear measurements and descriptions are performed following the protocol developed by NMFS for the bycatch observer program (Nance 1992) and a log is kept on water depth, bottom composition, weather conditions, tow duration, time of day, time of year, etc. Any gear failures such as fouled tickler chains, clogged TED's, or hangs are noted but not included in statistical analyses. Statistical evaluations include the Wilcoxon Matched-Pairs Signed-Ranks Test and the paired "T" test.

The methodology and forms developed by the NMFS Pascagoula/Galveston Laboratories are used for evaluation of bycatch reduction devices (BRD's). After each tow, the control and experimental catch are weighed for total biomass and shrimp. Every other tow (tows 1, 3, 5, etc.) is subsampled by taking one basket (approximately 65-70 pounds) from the control and experimental net. These samples are separated into the 20 species of interest outlined in the BRD protocol (Nance 1992) and length/weight data are obtained for individuals within each species. A clean data set is provided to the NMFS Galveston Laboratory at the completion of the field work.

Technology Transfer: Previous experience in similar work undertaken by the applicant has shown that the most efficient mechanism to effect TED technology transfer is either dockside or on-vessel demonstrations involving individuals or small groups of people. However, mass media such as newsletters, newspaper articles, radio and television spots are also used to inform fishermen of the availability of such services. The results obtained from the field tests are used to advise fishermen which TED's might work best for them given their particular set of circumstances.

A major goal is to help minimize or eliminate shrimp loss while at the same time effectively reduce bycatch in the inshore shrimp fishery. Where possible, arrangements are made to have a series of small "town hall" type meetings to present general knowledge regarding optimum TED choice, installation and utilization. Subsequent to these types of workshops/meetings, on-board assistance is given to vessel owners and operators.

Project Results and Benefits (To Date): The quantifiable results of this project are a documentation of experimentally determined bycatch reduction and shrimp retention rates associated with various TED designs used in small inshore shrimp trawls. This will assist fishermen in choosing the appropriate TED for their particular operating conditions. Other benefits include the reduction in shrimp loss as a result of such assistance, and the reduction in the potential for turtle capture as reflected by TED use improvements. This project should have a measurable impact upon the economic well-being of the production sector of the northern Gulf shrimp fishery as well as assist in the implementation of rules promulgated under the Endangered Species Act. Copies of reports and information generated throughout this project are sent to each appropriate agency in the Gulf including fishery management councils, fishery development organizations, the Gulf States Marine Fisheries Commission, the various Sea Grant Advisory Service programs, and state agencies charged with fisheries management. Articles in the monthly newsletter "Gulf Coast Fisherman" track the progress of the project and serve an additional role in enhancing participation. This project will serve to strengthen similar research projects conducted by NMFS, the Gulf and South Atlantic Fisheries Development Foundation, state resource management agencies throughout the Gulf and South Atlantic, and Sea Grant by expanding the data base being developed by those efforts.

The methodology and information developed by this project are of use to state and federal fishery management agencies throughout the Gulf of Mexico. Specific state agencies include the Florida Marine Fisheries Commission, the Alabama Department of Conservation and Natural Resources, the Mississippi Department of Wildlife, Fisheries and Parks, the Louisiana Department of Wildlife and Fisheries, and the Texas Parks and Wildlife Department. The project will also benefit the National Marine Fisheries Service and the U.S. Coast Guard due to their mandate to enforce TED regulations as well as any future bycatch reduction regulations which might be promulgated.

DEVELOPMENT AND IMPLEMENTATION OF FISHERIES BYCATCH MONITORING PROGRAMS IN THE GULF OF MEXICO—PHASE I PROJECT DESCRIPTION

Funding Agency: United States Environmental Protection Agency/Gulf of Mexico Program

Project Status: Ongoing

Project Goals and Objectives: The general goals of this project are to (1) conserve and restore species diversity and health of aquatic resources while allowing sustainable development, (2) assess and monitor the effects of fishing mortality on the health and abundance of living aquatic resources in the Gulf of Mexico, (3) enhance the sustainability of Gulf commercial and recreational fisheries, and (4) identify and assess the existing commercial and recreational bycatch data sets to determine research needs. The specific objectives of this project are as follows:

1. To conduct a Gulfwide survey of agencies and organizations to determine existing and on-going data sets and develop a data set catalog;
2. To compile and analyze these data sets, identify data gaps and develop a preliminary summary report for peer review;
3. To synthesize the data and produce a final report with data compilation;
4. To assist the Gulf of Mexico Program with information and technology transfer activities addressing fishery bycatch in the Gulf of Mexico by disseminating information developed under this project to a wide variety of user groups, fishery managers and the general public.

Identification of Problems: The total extent of shrimp trawl bycatch is largely unknown. The studies which do exist may or may not be representative of what is occurring in the fishery due to the seasons and areas in which they were performed. There is a notable gap in information regarding shrimp trawl bycatch in nearshore waters where the fishery is managed by the various Gulf and South Atlantic states. Although species which are prized by recreational fishermen comprise only a small percentage of finfish bycatch, sports fishermen have banded together with environmental groups in a well-organized effort to have regulations formulated to reduce the capture and destruction of nontarget species in the shrimp fishery.

Most of the research in the Gulf of Mexico regarding bycatch has been targeted toward the commercial shrimp fishery. However, many other fisheries and fishing

gears exist within the Gulf which also impact nontarget species. These include pelagic and bottom longlines, commercial hook and line, purse seines, trap fisheries, gill and trammel nets, recreational hook and line, finfish trawls, and recreational shrimp trawls. Bycatch in these fisheries is generated by incidental catch of nontarget species and release of regulated species which are under- or over-sized or out of season. Research regarding these other forms of bycatch may be found in referred journals but exists mainly in in-house agency documents and the "gray" literature. There is a need to compile this work in order to adequately assess the magnitude and extent of bycatch and related impacts on Gulf of Mexico living resources and ecosystems.

The bulk of ongoing work has been targeting bycatch in the Gulf and south Atlantic commercial shrimp fishery as a result of federal legislation which resulted in an amendment to the 1990 reauthorization of the Magnuson Fishery Conservation and Management Act of 1976, Public Law 101-627 (1990). This amendment required the Secretary of Commerce to conduct a study on shrimp trawl bycatch. This subsequently resulted in a cooperative research program between the National Marine Fisheries Service (NMFS) and the Gulf and South Atlantic Fisheries Development Foundation (Foundation) with direct involvement by the industry (e.g. the Texas Shrimp Association). Under this program, protocol was developed to use onboard observers to gather fishery-dependent bycatch characterization and gear modification/comparison data. Most of this work was conducted in federal waters (beyond the COLREGS line) because the bycatch species of greatest concern in the Gulf was red snapper. This joint industry-regulatory agency program has been highly successful. At the same time, many coastal states began working on the shrimp fishery bycatch issue in inshore waters and some have gone as far as requiring the use of bycatch reduction devices (BRD's) on shrimp trawls used in their respective state waters. The Sea Grant Marine Advisory/Extension network has played a crucial role in all aspects of this research and information and technology transfer by serving as an "honest broker" between researchers, management agencies, environmental groups, fishermen and the general public. In fact, NMFS and Sea Grant researchers, working with the industry, have been responsible for the development of gear technology with the potential to significantly reduce bycatch in the shrimp fishery while not adversely impacting shrimp production.

Approach: The coordinators involved with this project are widely known and respected throughout the Gulf and South Atlantic region for the expertise and skill they provide in trying to solve the often contentious issue of bycatch in commercial and recreational fisheries. Their research, networking, and information and technology transfer skills ensure the successful development and transmission of deliverables. The principal investigator, Dave Burrage, sits on the joint NMFS/Foundation/Industry steering committee representing Mississippi and Alabama and is actively involved in bycatch research. He has participated in Sea Grant in-service bycatch training programs, written numerous fishery bycatch publications, and presented the results of original research at scientific and technical meetings throughout the country. Dr. Steve Branstetter directs the Foundation's Gulf of Mexico and South Atlantic Shrimp Fishery Bycatch Research Program. He also has extensive experience with longline fisheries in the study region, particularly the commercial longline shark fishery. Dr. Rick Wallace has been actively involved with research leading to the documentation of the impact of recreational harvest on bycatch in trawl fisheries and has undertaken hook-and-line release mortality studies in the Gulf nearshore fishery. Gary Graham is serving as the Gulf Coast Coordinator for the Foundation's observer program, organized and helped implement a research/observer program for the Texas Shrimp Association, and is a former professional commercial fisherman. The non-Federal sources of funds and facilities used in the performance of the proposed project are provided by Mississippi State University, Auburn University and Texas A&M University.

The project is coordinated and receives administrative oversight through Mississippi State University's Coastal Research and Extension Center (CREC) located in Biloxi, Mississippi. Tasks are allocated to each contributing partner based on respective areas of expertise. Gary Graham (Texas A&M) provides coverage of the bottom longline and commercial hook and line fisheries. Dave Burrage (CREC) is primarily responsible for the gill and trammel net, purse seine, finfish trawl and recreational hook and line fisheries. Steve Branstetter (Foundation) takes the lead on the pelagic longline, commercial shrimp and trap fisheries. Rick Wallace (Auburn) is responsible for the Gulf-wide recreational shrimp fishery. The co-investigators have cooperated on similar projects and are linked informally through the Gulf & South Atlantic Fisheries Development Foundation, Inc. and formally through the Southeastern Association of Sea Grant Marine Extension Programs. Cooperators in the project are conducting a Gulfwide survey of agencies and organizations to deter-

mine existing and ongoing data sets; compile and analyze data and identify data gaps; synthesize the data and produce a final report. Contact points are state and federal fishery management agencies, private sector fishery organizations, academic researchers, environmental entities, the Sea Grant advisory network, the Gulf States Marine Fisheries Commission, and public/private organizations such as the National Fisheries Institute and fisheries development foundations. All technical and clerical support is provided by MSU/CREC.

Project-Results and Benefits (To Date): The Gulfwide survey of agencies and organizations began in April of 1995 and was completed in December of 1995. Data compilation and analysis will commence in 1996 and be completed in May 1996. The data will then be synthesized and a final report will be produced by the end of September 1996. Data sets are compiled using computer and literature searches as well as individual personal contacts throughout the Gulf region. The raw data is then analyzed by all of the project coordinators in order to produce a report summarizing the findings and suggesting areas which may be ripe for further investigation. Benefits developed under this project are widely transferable to any area of the world where fisheries bycatch is an issue of concern (e.g. the north Pacific groundfish industry). These benefits include development of a protocol to gather and analyze bycatch data and manage fisheries, development of more efficient fishing technologies, improved stock assessments, reduced fishery mortality rates, increased population stability, and maintenance of "natural" biodiversity.

STATEMENT OF DR. DOUGLAS L. MARSHALL, PH.D., ASSOCIATE PROFESSOR AND ASSOCIATE FOOD SCIENTIST WITH THE DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY, MISSISSIPPI AGRICULTURAL AND FORESTRY EXPERIMENT STATION, MISSISSIPPI STATE UNIVERSITY

Senator COCHRAN. Dr. Marshall is next.

Dr. MARSHALL. Thank you Senator Cochran, I appreciate the opportunity to come here and share the results of some of the research that USDA is running through the special grants. I am an associate professor in the Department of Food Science and Technology at Mississippi State University. The topic I will be discussing with you today is seafood aquaculture harvesting, processing, and marketing.

This is a collaborative project among several scientists.

There are four major research areas that this project addresses: seafood quality and seafood safety are the first two, and then seafood processing byproducts is the third. Taking the technology for products developed on the first three objectives we can do some economic development on these facilities with new technology.

One of the first areas of concern is addressing a perceived consumer perception of unsafe foods, particularly seafoods. As you recall a couple of years ago, some reports had a scathing article on the quality and safety of seafood products and they did not have very many fine words to say about catfish.

In order to address this concern we are looking at using multiple types of barriers, whether they are chemical or physical, to control microorganisms particularly in oysters and catfish. You heard already about the *Vibrio vulnificus* in oysters. This virus is a recurring problem with the seafood processing industry. For example, 2 months ago, the major processor of catfish in Arkansas had a virus that required FDA action.

This is just a listing of techniques we are using in the laboratory to try to address and control the viral organism. To date, some of our accomplishments: we developed test systems to study the use of chemical treatments and we have identified specific organic organisms in catfish. This is just an example of the research that we are doing and the ultimate goal is safe foods for the consumer.

One of the other projects is related to seafood quality. One of the best analytical tools we have is the smell test to see whether or not seafoods are safe. If you are not able to smell the off-flavored fish, you may have difficulty in deciding what kind of fish you may want to eat or not.

So, one of things that we tried to do is develop an objective analytical technique to determine the standards for the seafood. And we also have managed to extend the shelf life. In order for Mississippi seafood and aquaculture foods to stay competitive in the market, we have to ensure that the product can survive transport out of the State to the consuming market. What we have found, as the result of our research, is that we could use various products to extend the shelf life of the product anywhere from 3 to 9 days over conventional methods. And we also developed a rapid—we can get a result in 30 minutes—automated impedance method determining microbial numbers that can objectively measure seafood spoilage.

This is the appearance of some of these acid-treated catfish filets. If you are a chef, you might desire the darker color filet after cooking compared to a lighter color of the filet that was not treated. All of these, by the way, are both acceptable to the consumer.

And the last one is seafood byproduct utilization. Much of the raw materials going into a processing plant, at least about one-half, is discarded as waste. Now, that either goes to rendering plants or animal food production or it goes into our waste streams so it can be landfill or water supply.

We have an interest in using this byproduct to develop food for human consumption or food for animal consumption and some of what I have here for you today is a handout where we developed a prototype product that is fully edible and if you want to use that for your appetizer before lunch, please do so.

And also I have an extract that we have developed from blue crab processing byproduct. This basically is the essence of blue crab. It is water soluble and if you want to try some of this afterward, I will be happy to share it with you.

So, the accomplishments then. We developed commercially acceptable surimi with our seafood analog products, using the byproducts of processing. The jerky product is something that I have today and everyone in the audience is fully able to take that and consume it.

PREPARED STATEMENT

I'm going to stop here and let the next speaker speak. Thank you.

Senator COCHRAN. Thank you Dr. Marshall for your interesting presentation.

[The statement follows:]

PREPARED STATEMENT OF DR. DOUGLAS L. MARSHALL

Douglas L. Marshall, Ph.D. is currently Associate Professor and Associate Food Scientist with the Department of Food Science and Technology, Mississippi Agricultural and Forestry Experiment Station, Mississippi State University, Box 9805, Mississippi State, MS 39762-9805. He has a B.S. and M.S. from the University of Nebraska in Biology and Food Science & Technology, respectively. His Ph.D. is from the University of Florida in Food Science & Human Nutrition. Prior to joining MSU in 1994 he served on the faculty at Louisiana State University for 4 years. His re-

search interests are in the areas of food safety and quality enhancement, with particular emphasis in seafood and aquaculture processing. He has published over 80 research articles relating to this area.

SEAFOOD AND AQUACULTURE HARVESTING, PROCESSING, AND MARKETING IN MISSISSIPPI

Seafood Safety Research

The U.S. Public Health Service, with the cooperation of States and the shellfish industry, have the responsibility of insuring that raw and frozen shellfish shipped in interstate commerce are safe for human consumption. This task is difficult due to polluted estuaries that are the primary source for shellfish products. To protect consumers, numerous closures of shellfish harvesting areas in Mississippi have occurred.

The U.S. Food and Drug Administration recognizes two methods to clean oysters harvested from domestically polluted waters. One method, relaying, involves harvesting oysters from closed waters and transplanting them into approved waters for at least 14 days. The second method, depuration, involves a process of self-cleansing in an offshore facility where the water is treated by ozonation or ultraviolet irradiation before it is fed into tanks containing oysters. Currently recognized limitations of depuration and relaying include: (1) not all pathogens are purged at the same rates from oysters and that viruses may even take longer times than currently set standards, (2) the adopted coliform count does not reflect accurately the purge status of pathogens from oysters, and (3) that pathogenic human viruses and vibrios have been isolated from shellfish harvested from "safe" waters.

This project seeks to incorporate generally recognized as safe compounds to reveal potential for control of *Vibrio vulnificus* that is associated with gastroenteritis and fatal septicemia following consumption of raw oysters. Screening of GRAS compounds may lead to improvement of the microbiological quality and safety of either live or shucked oysters. Potential economic impact on the Mississippi oyster industry of such positive findings need not be further emphasized.

Seafood Quality Research

Preharvest quality of seafood is influenced by season, fluctuation in species concentration, weather, food supply, disease, pollution, and over-harvesting. Postharvest seafood quality is largely a function of time and temperature during storage and transportation. Detrimental changes occur in seafood before, during, and after processing. Many of these changes affect nutrient content, microbial loading, texture, flavor, and color, with each influencing consumer purchasing decisions.

Acceptable seafood quality depends on the degree of product decomposition. Spoilage is the condition of unacceptable product quality caused by decomposition, while freshness is the condition of acceptable product quality that results when little or no decomposition has occurred. The Food and Agriculture Organization specifies that fish classified as fresh are of acceptable quality for consumption and may be chilled but not preserved in any other manner. The Food and Drug Administration (FDA) classifies acceptable seafood quality as products with little or no decomposition that are suitable for consumption. Associations such as the National Fisheries Institute desire mandatory seafood inspection to provide more control of seafood quality. However, problems arise when establishing inspection standards with the important question being: What form of evaluation is acceptable as well as efficient? An alternative to inspection is the use of hazard analysis criteria throughout all stages of handling, processing and storage. Critical Control Points are identified as those stages in the product flow where unacceptable risks may occur. Implementation of Hazard Analysis Critical Control Point (HACCP) programs can be beneficial to the seafood industry by decreasing the amount of product lost due to faulty processing and supporting inspection. As such, the U.S. FDA has recently required mandatory HACCP for the seafood industry.

Microorganisms produce undesirable odors during seafood spoilage. Generally, decreasing sensory acceptance is related to increased microbial growth. Microbial enumeration by standard methods is neither simple nor rapid. A more rapid method for determining microbial numbers uses impedance technology. The organic electrolytes produced during microbial metabolism will increase the conductivity of the medium. Impedance devices measure the amount of current passing through the medium, which can be calibrated with microbial numbers. Using impedance to detect the production of electrolytic products manufactured by microorganisms and endogenous enzymes can objectively measure seafood spoilage within 30 minutes.

Seafood By-Product Utilization Research

With a seemingly shrinking fisheries base, further growth of the Mississippi seafood industry is contingent upon improved resource management and technological innovation. Presently, large volumes of seafood processing by-products are being discarded at a cost to processors. Significant potential exists for value-added processing of these by-products into commercially viable products. Such efforts not only address environmental concerns but ultimately lead to increased profits for seafood processors.

The scope of this project is such that it addresses local, regional, and national concerns regarding the health and safety of seafood products as well as use of prudent seafood processing strategies that reduce pollution and ensure optimal resource utilization.

The goal of this research was to develop innovative technology-based alternatives for the conversion of seafood processing by-products into potentially marketable flavor extracts. Crab processing by-product (CPB) was chosen as a model feedstock for technology development and feasibility studies. Exhaustive study of the flavor chemistry of blue crab meat and CPB has indicated that high quality flavor extracts can be derived from CPB. Optimum conditions for enzymatic recovery of flavor principals from CPB's have been established. Study of the process chemistry and technological constraints involved with production of high quality and marketable flavor extracts is on-going.

STATEMENT OF DR. MICHAEL L. JAHNCKE, PROGRAM COORDINATOR OF THE NATIONAL SEAFOOD INSPECTION LABORATORY OF THE NATIONAL MARINE FISHERIES SERVICE, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, U.S. DEPARTMENT OF COMMERCE

Senator COCHRAN. Dr. Jahncke, you are the next one on the list.

Dr. JAHNCKE. Thank you Senator Cochran, I appreciate the opportunity to appear before you. I have submitted written testimony to your staff. I am going to very briefly summarize the high points of it.

My name is Michael Jahncke, I am the program coordinator of the National Seafood Inspection Laboratory of the National Marine Fisheries Service in Pascagoula, MS. I am also an adjunct professor in the Department of Food Science and Technology of Mississippi State University.

What I would like to do is talk about research efforts, past and future, of the joint State and National Marine Fisheries Service, cooperative seafood processing complex in Pascagoula. I am going to be talking primarily about the processing and address some of the more recent food safety research activities.

The purpose of the facility as it was originally established is to conduct research on the safety and quality of products in Mississippi and throughout the gulf region.

The original objective of the processing complex was to produce surimi and other value-added products from catfish frames, menhaden, and other coastal fishes; develop information and utilization on the processing and quality of fishery products; and to address what are the real issues to keep these profitable.

In addition, this facility is an excellent facility for providing hands-on training for students, industry, and government personnel and provides a state-of-the-art seafood processing facility for research.

We are in a unique location to take advantage of the research opportunities, using catfish frames, menhaden, and other coastal fish. Primarily, catfish frames are byproducts of catfish processors, currently discarded as waste material with little economic return to the processor. Menhaden is an industrial fish used by the menha-

den industry to produce primarily fishmeal and oil. Last year the total harvest of menhaden was 28 million pounds.

Last, the Gulf of Mexico contains one of the two remaining major latent fisheries in the United States. These underutilized or latent resources contain many species of fish that are small in size and not readily accessible by traditional fish-locating and harvesting methods. Similar types of species are currently consumed as food in many countries. Some of it is used as baitfish. Potential annual harvest of this complex is estimated to be about 1 billion pounds.

PREPARED STATEMENT

Past efforts at the processing complex, include research conducted using catfish frames and menhaden. Work was conducted on producing surimi and other seafood products. There are a couple of companies in Mississippi currently evaluating the use of catfish frames for products. As the result of this, the catfish frames have proved excellent for white bland flavored fish product. Menhaden is also used to produce a high-quality mince and surimi product. It does have a slight gray color and stronger flavor and odor attributes than traditional surimi products. Preliminary research at the facility demonstrated that by adjusting the pH of the wash water, the flavor, odor, and color of the menhaden surimi could be improved.

[The statement follows:]

PREPARED STATEMENT OF MICHAEL L. JAHNCKE

Senator Cochran and other members of this distinguished panel, I am Michael L. Jahncke, Program Coordinator of the National Seafood Inspection Laboratory of the National Marine Fisheries Service (NMFS) in the National Oceanic and Atmospheric Administration, an Agency in the U.S. Department of Commerce (NMFS/NOAA/DOC). I am also an adjunct professor in the Department of Food Science and Technology of Mississippi State University (MSU).

I appreciate the opportunity to appear before you today to give you a brief overview of the joint MSU and NMFS research activities conducted at the MSU/NMFS Experimental Seafood Processing Complex located in Pascagoula, Mississippi, adjacent to our numerous NMFS facilities and activities.

The Mississippi Agricultural and Forestry Experiment Station (MAFES) and Mississippi Cooperative Extension Service (MCES) of Mississippi State University, and NMFS with additional financial assistance from Jackson County, established a state-of-the-art cooperative experimental seafood processing laboratory complex in Pascagoula, MS. Seafood processing equipment was transferred on a long-term lease basis to MSU from our NMFS Charleston, South Carolina Laboratory. The Seafood Processing Complex also contains a modern Federal NMFS seafood inspection training facility. MSU owns the buildings in the complex and has administrative oversight responsibility of the entire processing complex.

The complex is cooperatively staffed with a senior research scientist from the MAFES/MCES, and our NMFS Charleston Laboratory. Three of our senior Southeast NMFS inspection personnel responsible for inspection supervision, training and Hazard Analysis Critical Control Point (HACCP) inspection activities are also stationed at the complex. Additional scientific and technical staff support is made available from MCES, the MSU Food Science Department, the National Seafood Inspection Laboratory (NSIL), and the NMFS Charleston Laboratory on an "as needed" basis to carry out the research activities of the complex.

I will be speaking today about the seafood handling, processing, quality and product development research activities conducted at the complex. Dr. Douglas Marshall of MSU will address some of the more recent food safety research activities.

Research activities at the complex are focused on the Gulf of Mexico, and in particular on Mississippi in coordination with the aquaculture and other seafood industries. Specifically, we have proposed: (1) research to produce surimi and other value added products from catfish frames, menhaden, and the coastal herring complex species for domestic and international markets; (2) research to obtain information

on nutritional composition, yields, and handling and processing requirements of Gulf of Mexico fish species so that appropriate commercial business decisions can be made; (3) research to address water re-use issues in the seafood processing industry, since water re-use is becoming increasingly recognized as one of the major hurdles which must be addressed as we approach the 21st Century; (4) provide "hands on" training for graduate students, government inspectors and industry personnel in a processing environment and; (5) we have made available a state-of-the-art facility to the industry so that they can conduct proprietary type research activities.

I will now briefly discuss some of the past research efforts conducted at the facility.

1. One of the first research projects conducted at the Experimental Seafood Laboratory Complex centered on producing value added products (e.g., surimi) from catfish frames. Approximately 18 percent of the live weight of catfish is frames which are considered as processing wastes. They are shipped to a rendering plant with little or no economic return to the catfish processor. The MSU/NMFS research facility was one of the first in the country to conduct studies on the use of catfish frames to produce high quality mince and surimi products.

Research activities on the use of food grade antioxidants and reductions in wash water volumes were also investigated for their effect on improving the quality of surimi and mince products produced from catfish frames. As a result of our research efforts, processors in Mississippi are considering investigating the possible use of catfish frames to produce value added products. Future research activities in this area will focus on food safety aspects, quality retention, process water reduction requirements, flavor characterizations, storage and shelflife stability, etc.

Other past successful research efforts at the facility focused on the use of Gulf menhaden to produce mince and surimi-type products. Menhaden represents one of the largest volume fisheries in the U.S., but almost all of it is reduced to fish meal and oil. The unique equipment and research capability of the Pascagoula processing complex, and its close physical proximity to the Gulf of Mexico, has allowed researchers to conduct studies on the use of Gulf menhaden to produce high quality value added human food products from menhaden. This research has shown that Gulf menhaden when properly handled can be used to produce high quality mince and surimi for subsequent use in higher value human foods. Menhaden surimi has good functional characteristics for incorporation into human foods, but does have a slight gray color and stronger flavor and odor attributes than traditional surimi products. Preliminary research at the facility demonstrated that by adjusting the pH of the wash water the flavor, odor and color of the menhaden surimi could be improved.

As with the catfish frame recovery project, future research efforts will focus on reducing wash water volumes, adjusting water pH along with the use of food grade antioxidants to lower processing costs and improve color, flavor, increase processing yields and extend the shelflife of menhaden surimi. This application driven research is needed by the seafood industry if it is to successfully use this species to produce value added human food products. Companies have requested information and explored the possibility of commercially producing surimi from menhaden.

2. The Gulf of Mexico contains one of the two remaining major latent fisheries in the U.S. These underutilized or latent resources contain many species of fish which are small in size and not readily accessible by traditional fish locating and harvesting methods. The coastal herring species complex is a relatively small fast growing group of species that have a life span rarely more than three years, reach sexual maturity early and are highly prolific. Little published information exists on proper handling, holding and processing methods for producing human food from these species. Similar types of species are currently consumed as food in many countries. Potential markets exist for some of these coastal herring species in the frozen round form, but future research efforts need to be directed toward a comprehensive resource utilization research program for producing value-added products for domestic and export markets.

Initial research efforts conducted at the Pascagoula processing complex focused on the effects of various on-board handling techniques on the storage quality of several species within the coastal herring complex. Basic information on the chemical composition of several species has been also determined. Preliminary results indicate that they are high quality fish. They have excellent potential for producing value-added products having a significant potential for full development, provided an integrated comprehensive research approach is used to overcome some of the handling and processing challenges.

3. An area of increasing concern for seafood processing plants is the high cost of water usage, the need to conserve water, and reduce waste water discharges from the processing plants. The requirements for large volumes of water for processing

surimi and other seafood products has created societal impediments to further development of seafood processing operations in Mississippi and in many other parts of the country. The Pascagoula Experimental Seafood Processing Complex is ideally equipped and situated to conduct studies on water re-use methodologies and processing techniques to minimize waste water discharge from seafood processing plants. Successful research efforts from these activities will benefit the seafood processing industry throughout Mississippi and the U.S.

4. Training in a variety of seafood processing techniques has been provided to, graduate students of the Food Science Department of MSU, industry personnel and foreign scientists at the Experimental Seafood Processing Complex. This facility has provided an opportunity for graduate students and others to work with commercial size equipment and processes. It has also allowed students a unique opportunity to interact with university and government research scientists, and industry personnel, exposing them to a variety of different research objectives and approaches.

5. The use of the Experimental Seafood Laboratory by private industry for proprietary research purposes has also been notably successful. Several private companies have used the facility and its state-of-the-art processing equipment to test new methodologies for product development. Research activities have been conducted with tilapia, hybrid striped bass, red fish, menhaden, catfish and catfish frames, poultry products, etc. Foreign scientists have also been trained at the facility in surimi production and proper seafood plant sanitation techniques. Recently a national company used the facility to film a training video on proper hand washing procedures. We in NMFS use the facility to train new seafood inspectors in proper plant sanitation procedures, and will shortly be filming a training video on proper plant sanitation at the facility for use by Federal and state seafood inspectors.

This concludes my presentation. I have briefly discussed joint MSU and NMFS research activities conducted at the Experimental Seafood Processing Complex. The success of these programs to date has resulted from cooperative partnerships between MSU and our Agency, and many others. It has provided demonstrated benefits to the seafood industry as well as provided unique educational experience to university graduate students, Federal, State, and industry personnel.

Thank you for the opportunity to appear before you. I would be happy to answer any questions.

USE OF FEDERAL DOLLARS IN RESEARCH PROGRAMS

Senator COCHRAN. Thank you very much Dr. Jahncke. Let me say that I think your summation is very appropriate. It seems to me that one of the things that we can learn from this and other hearings on the use of Federal dollars in research programs is to be sure we keep in mind the practical objectives, such as the enhancement of quality of life and economic goals in helping private industries and businesses solve problems that they can't afford to deal with on their own budgets with their own resources.

These are practical problems that were described throughout this panel's testimony that are targeted for special attention by these programs. I think one question that I have is: What if we didn't have some special grant options available to us as a source of providing funds for special regional problems like we have in the southeast region? What would we do? Would there be any way to make up for that lack of resource through the competitive grant process? I may direct that question to Dr. Hurt and Dr. Veal who may have special experience with competing with larger universities in other regions of the country for Federal research moneys. What would be your reaction to that question?

Dr. HURT. Mr. Chairman, I think we would be in deep trouble for several reasons, one specifically. You notice the issues that we were addressing primarily were issues of the gulf region and the State of Mississippi. Catfish, gulf resources, seafood, shrimp, most of that kind of activity is in this region of the country. We would have to compete nationally and probably undergo a review by a

peer panel. This panel would be comprised of a majority of members from other regions of the country more than likely. At least that is the experience that we had.

We would also want to have the reputation, the infrastructure, the visibility of some of the other gulf-financed institutions. I think we have some major difficulty in being competitive and addressing the kind of issues that serve the Mississippi catfish industry and the Mississippi gulf coast resources and marine industry that we have.

Senator COCHRAN. Thank you very much. Dr. Veal, would you like to add to that or to comment?

Dr. VEAL. I personally second that. We would be in a great deal of difficulty without these Federal grants. It is difficult from a program standpoint to compete nationally with the best known institutions that have many more resources available than that we have in Mississippi. I guess from a staff standpoint, in competing for and getting the grants around the country from a number of agencies, in some cases we have been successful and some cases very successful. But as a general rule with competitive grant processes, my observation is the rich get richer the poor get poorer. We come from a poor State and a poor region and we don't have as many resources as some of the other parts of the country and without this process, it would be very difficult for us to compete on any economic basis.

Senator COCHRAN. Well, I appreciate hearing your answer to that situation. I am convinced that we have to keep trying to ensure through the legislative process in Congress that these funds are fairly and equitably distributed through all the regions.

I am not sure how the process could be any better than the access that we have through the special grants, CSREES-administered funds. Some people do not know that those grants are actually evaluated and they are monitored. I think the testimony that we had from the first panel talked about three different reviews that have been undertaken by the Department of Agriculture to evaluate and try to make sure that the funds that are being used were justified and that the programs were cost effective. That is something that most people don't know, but it is undertaken in a very conscientious way, I think from my experience, by the Department of Agriculture.

An observation that I have in connection with Ms. Holloman's testimony was the model legislation that we discussed. Although initial work was done there, there is still needed research in the area of quality production.

I also appreciate very much the panel here telling us about specific programs and activities. One thing that I hope that we are doing, I don't know who is best to comment on this, maybe Dr. Veal, is on all of these programs, we maintain a line of communication with the private sector, the private businessperson or other person who is out there. I know you were talking about the realtors and the communication you have with them, to be sure that we maintain the support of the public for what we are doing. If people get the idea that a project is a "pie in the sky" dream of the academic researcher, without any practical application, we are no

longer going to be able to get the taxpayer support for the continued funding.

What effort is made, for example, with local fisheries, industries, processing industries, and marine fishery businesses, to maintain a line of communication to make sure that we are on the right track as far as they are concerned with what we are trying to deal with and the problems we are trying to solve?

Dr. VEAL. Addressing that problem is part of the everyday bread and butter of our program. We carry on our excellent research programs. All of them are magnified by our professionals in dealing with user groups, like realtors, like teachers, like seafood processors, like commercial fishermen, and many other industries. They do that as a fact of life.

The research activities that they have discussed today and the activities of the Gulf Research and Extension Center are the direct result of our continued interaction with those industries. Our continued efforts to deliver information, to deliver technology, not only from our own research but from the Land-Grant System at the University and Research Center.

So addressing those issues ensures timely input into our research program. It is really the very basic task that we use to identify those research needs to start with. It is the thing for us to achieve.

ADDITIONAL MATERIAL SUBMITTED

Senator COCHRAN. I appreciate that and I hope to stress that those questions are important. I think that is an essential political part of life, too. We have a representative process here and we have an obligation as representatives of the State at large and people throughout the Congress to be sure that everybody's views are taken into account. And for that purpose, I do want to invite, again, anyone who wants to submit a statement in letter form to me formally, or any other way, to please feel free to do that. I will make sure that it is included in the hearing records so we have the full impressions and views of people of this area on how we are approaching the challenge of using research dollars to solve everyday problems that we have.

[The information follows:]

PANEL ONE

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD ON THE U.S.
MARINE SHRIMP FARMING PROGRAMLETTER FROM EDWARD M. WILSON, DEPUTY ADMINISTRATOR,
COOPERATIVE STATE RESEARCH, EDUCATION, AND EXTENSION SERVICE

Mr. Jan E. Dill
The Oceanic Institute
Makapuu Point
Waimanalo, Hawaii 96795

25 SEP 1995

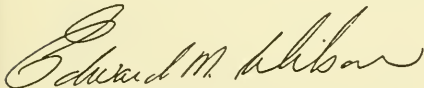
Dear Mr. Dill:

We are pleased to transmit seven copies of the CSREES Special Review Report of the U. S. Marine Shrimp Farming Program, which was conducted by Drs. Meryl Broussard (WA D.C.), George Chamberlain (MO), Harry Daniels (NC), and Bill Simco (TN). Each team member has been sent a copy of the report and has been asked to respect the confidentiality of the information. We hope the comments, suggestions, and recommendations in the report will be useful to the Consortium.

As in the past, CSREES would like to receive a follow-up report from the Consortium within the next six months describing the extent to which the findings and recommendations from the review have been considered and whether or not they were implemented. Again, as in the past, I would also recommend that the CSREES Program Manager, Dr. Meryl Broussard, and the Consortium Coordinator, Dr. Gary Pruder, meet within the next six months to discuss the findings and recommendations of the review team. While I recognize that all recommendations may not be implemented, your comments will be helpful to CSREES as we evaluate the impact of our activities, particularly the on-site review of our programs.

Please feel free to contact Dr. Meryl Broussard (202-401-5787) if you have any questions about the report

Sincerely,



EDWARD M. WILSON
Deputy Administrator

SPECIAL PROGRAM REVIEW

U.S. MARINE SHRIMP FARMING PROGRAM, UNIVERSITY OF ARIZONA

Conducted by:

The Cooperative State Research, Education, and Extension Service

INTRODUCTION

SITUATION

The U.S. Marine Shrimp Farming Program was initiated in Fiscal Year (FY) 1985. The primary long range Program objective is to expand domestic production of marine shrimp through aquaculture. Research under the Program has been directed at high priority opportunities to improve the production efficiency, profitability and sustainability of the U.S. commercial shrimp farming operations. Commercialization of technologies developed through the Program should enhance the competitiveness of the U.S. aquacultural interest in a global economy.

From 1991 to 1994 the U.S. marine shrimp farming industry experienced significant expansion with annual production reaching 5.8 million pounds in 1994, up from 2.6 million in 1991.

The research Program is implemented through the Gulf Coast Research Laboratory Consortium (GCRLC). The Consortium is composed of the Oceanic Institute (OI), the Gulf Coast Research Laboratory (GCRL), Tufts University (TUFTS), the Waddell Mariculture Center (WMC), the Texas Agricultural Experiment Station (TAES), and the University of Arizona (UAZ). Additionally, research is carried out at the University of Southern Mississippi under a subcontract. OI and the GCRL serve as primary contractors to USDA. Institutional membership and interaction within the Consortium are guided by a Memorandum of Understanding (MOU).

The first in depth review was conducted in 1988 at the GCRL in Ocean Springs Mississippi. The 1988 review highlighted program accomplishments and provided recommendations to strengthen Program activities and Consortium management. Following the first review the Cooperative State Research Service (CSRS), USDA, and the Consortium agreed to conduct an in depth review of the Program approximately every three years. The second review was conducted in 1991 at the WMC in Bluffton, South Carolina. Emphasis was placed on evaluating progress and developments since the last review, and the review of future program. The third review was held March 29-31, 1995 at UA, in Tucson, Arizona. The emphasis of this review was to evaluate the impact of the Program on the U.S. shrimp farming industry.

REVIEW GOAL

To assist the Consortium in improving the quality, planning, relevance, coordination and direction of the research program in order to maximize the impact of the Program on the U.S. industry, through the adoption and commercialization of technology generated from the Program.

REVIEW OBJECTIVES

- 1) To evaluate the impact of the Program on the industry and to assess the commercialization of technology generated by the program.
- 2) To evaluate and measure progress made toward meeting stated research objectives and to identify opportunities to strengthen and improve the quality of research.

- 3) To identify opportunities to strengthen and improve planning and coordination of Program efforts.
- 4) To review and evaluate the FY 1995 implementation plan.
- 5) To assess the implementation of recommendations from the previous review.

REVIEW FORMAT: An external review team consisting of three leading scientists from the public and private sectors led by the CSREES Principal Aquaculture Scientist conducted the review. The formal review lasted two days. The review consisted of meetings, informal interviews, formal presentations, and group discussions. Free and open exchanges of ideas among Consortium scientists, administrators, and the review team were encouraged. The review team relied heavily on formal presentations, the FY 1995 implementation plan, recent progress reports, the "10th Anniversary Review" and additional documentation provided by the Consortium Coordinator.

The primary Program areas addressed corresponded to objectives stated in progress reports and the FY 1995 implementation plan. Program organization and management were also addressed.

REVIEW REPORT: The review team developed a draft report during the on site visit. An oral preliminary report was presented to the Consortium Coordinator and GCRL representatives. The final written report was edited by the review team leader.

The review report is organized to reflect past and present thrust of the Consortium. The report includes the following major sections: 1) Organization and management, 2) Industry Seed Supply 3) Disease Control and Animal Health 4) Environmental Quality recommendations 5) Shrimp Production Technology. A general overview is presented for each Program area as well as past findings, present findings, future directions, comments and recommendations.

ORGANIZATION AND MANAGEMENT

BACKGROUND

The GCRLC was established in 1984 by agreement between OI and the GCRL. As the activities of the Consortium have expanded, organizational and management structures have evolved to address the needs of the program. The Consortium presently operates under a MOU signed by representatives from all participating institutions. Consortium programs are administered through a contract with CSREES, USDA. Funds are provided as a direct Federal administration appropriation. The Principal Aquaculture Scientist within CSREES serves as the USDA Program Manager.

In accordance with the provisions of the MOU, the Program interaction and cooperation is guided by the Executive Committee, a Technical Committee and a Program Coordinator. Policy setting authority, research direction, setting of priorities, and resource allocation among project areas and institutions are vested in the Executive Committee. One principal investigator from each institution serves as a member of the Technical Committee. The Technical Committee evaluates and documents the constraints and opportunities faced by the domestic marine shrimp farming industry and submits recommendations concerning research direction and priorities to the Executive Committee for consideration.

The Program Coordinator serves at the pleasure of the Executive Committee. Responsibilities include the overall management and coordination of the Consortium. The Program Coordinator serves as an interface with the Executive Committee and Technical Committee, and provides linkage with the CSREES Program Manager.

CONSORTIUM APPROACH

The Consortium has focused on the identification and resolution of constraints faced by the domestic shrimp farming industry. This problem solving approach includes basic and applied research, technology development, and technology verification through cooperative farm and field testing. Allocation of resources has shifted as research priorities change over time to respond to industry needs and new opportunities. The Consortium works in close cooperation with the U.S. shrimp farming industry.

At least once a year the Consortium reassesses its focus, priorities and allocation of resources. In 1994 the Consortium asked each commercial producer and support operations in the U.S. to identify opportunities to increase profitability, ensure sustainability, and continue the expansion of the industry. The recommendations from the industry were published in a special edition of "Industry Briefs," a newsletter published by the Consortium.

The Consortium identified five factors that strongly influenced the Program's direction and content in developing the FY 1995 implementation plan:

- 1) Increasing profitability, capability and competitiveness of commercial shrimp farming operations in the U.S., based on partial development and transfer of advanced technologies, products, and services.
- 2) Major undertakings in establishing reliable captive supplies of domesticated high health genetically improved shrimp stocks, disease diagnosis, prevention and treatment methods and environmental protection technologies and products that are impressive but; yet, incomplete. Since such projects are essential and do not lend themselves to partial funding, they must be assured adequate funding allocation.
- 3) Decreasing levels of congressional initiative support for the shrimp industry development program.
- 4) Devastating losses suffered by foreign shrimp farming countries due to deteriorating stock, environmental quality and disease, which have energized interest and strong demand for the export of advanced technologies, products and service from the U.S. private sector.
- 5) Acknowledgements that the success or failure of the USMSFP will be judged largely by the degree to which the products, technologies and services it develops are adopted, implemented and exploited by the private sector, rather than the extent to which the private sector is subsidized by the USMSFP products, technologies, and services.

In order to respond to these factors and the changing needs of the industry, a workshop involving the Executive Committee and the Technical Committee was held in Tucson, Arizona in November of 1994. Projects and institutional assignments for the FY 1995 implementation plan were finalized.

Funds have been allocated to research and development efforts designed to extend and accelerate advanced technologies, products and services for exploitation by U.S. companies for domestic production and foreign export purposes. These efforts were concentrated into three multi-institutional project and subproject areas: Seed Supply, Disease Control and Animal Health Assurance, and Environmental Quality and Best Management Practices.

PREVIOUS FINDINGS

During the 1991 review, the review team was pleased with the progress made in the management and organization of the program. Although the Consortium did not adopt all recommendations made in the previous review, the Consortium did adequately address all concerns expressed and has taken effective action. Improvements had enhanced administrative efficiency, Program content, team work, and overall Program morale.

The Executive Committee and the Technical Committee were functioning well. The team had noted that "The Program Coordinator has done an outstanding job in the implementation of the Program over the past three years."

The review team noted that description of research protocols and methodologies could be expanded to provide more information to evaluate the scientific approach utilized. The review team concurred with a recommendation presented by the Executive Committee during the review, that the Program be treated as an integral part of USDA's overall aquaculture program. Although the Program is identified as a Congressional initiative, it is consistent with USDA's mission in aquaculture and the National Aquaculture Development Plan.

The review team recommended that the Consortium continue to improve the scientific quality and design of all components. The team encouraged strong external and internal peer review of all experimental design. The team urged a continued effort to strengthen team work on all Consortium tasks with a commitment to excellence in science.

CURRENT FINDINGS

The current organization and management of the Consortium is efficient. The Executive Committee, Technical Committee, and Program Coordinator continue to work effectively in a well coordinated manner. The review team pointed out that the Program Coordinator continues to do an excellent job.

The team noted that the Technical Committee and professional staff at the various institutions interact well. The team of scientists and technical staff on the various components of the project have developed a great deal of interdependence and cooperation. Institutional boundaries are not evident. There is excellent cooperation across institutions and across Program areas. The various institutional components and Program thrusts are well integrated.

The Consortium has responded well to the needs of the industry, and has done an excellent job of reallocating resources to address important opportunities. The allocation of resources during a time of declining resources has been handled well by the Consortium. Resource allocation has been based on Program needs rather than the needs of the individual research institutions.

COMMENTS AND RECOMMENDATIONS

The review team commends the direct linkages with the industry in priority setting and program implementation. These linkages have maximized technology transfer.

INDUSTRY SEED SUPPLY

BACKGROUND

The availability of quality shrimp seed had been identified by the Consortium as a major constraint to the development of the U.S. shrimp farming industry. The Consortium has allocated significant resources to improving seed production systems and improving seed quality. Research has been directed at broodstock maintenance and maturation, mating procedures, hatchery technology, larval rearing, and seed quality. Research efforts directed at the production of SPF (specific pathogen free) seed became a priority within the Consortium and substantial resources have been allocated to research and facility development in this area. The recent expansion and profitability of the U.S. marine shrimp farming industry over the past four years is in part a result of the availability and use of high health shrimp seed from the broodstock developed by the Consortium.

The Consortium has also recognized the need to address genetics and animal breeding as an integral part of a high quality seed development program. A significant redirection of resources has occurred to address this important area. The development of the high health seed program requires improvement in quarantine facility design and operations, completion of a state-of-the-art nucleus breeding center, execution of a sophisticated shrimp breeding program, and an industry driven multiplication and seed production system. It is also clear that the seed supply component of the Program must be completely integrated with the animal health component of the Program.

PREVIOUS FINDINGS

The previous review team had indicated that institutions involved in this research area had made substantial progress and their overall impression of the work in this area was favorable. The review team recognized the improved scientific rigor of this component of the program. The OI maturation and hatchery procedures had been refined and were much more predictable. Facilities, generally, were on line but there still was a wide range of efficiency from facility to facility in terms of seed production. The team indicated that steps taken toward standardizing hatchery procedures at other institutions may alleviate the problem.

The review team was particularly pleased with the development and implementation of the broodstock improvement program. The Consortium was able to utilize some of the best expertise available in the world in a very productive format. The team felt that the recommendations from the breeding workshop and the proposed breeding plan were on target. The review team recommended the continuation of the use of external consultants in the implementation and review of the breeding program. The team strongly supported the development of the nuclear breeding center as outlined by the Consortium.

The team recognized the importance of the basic research that was underway at Tufts University addressing nuclear and mitochondrial DNA polymorphisms and the importance of integrating this research into the breeding program. The team also indicated that the

breeding program could serve as a model to illustrate the compatibility between aquacultural breeding programs and genetic conservation programs.

The team recommended that the Consortium reconsider approaches to certification of seedstock that address the health status as well as performance characterization. The future privatizing of seedstock/broodstock supplies should be encouraged.

PRESENT FINDINGS

The development of high health seed by the Consortium and distribution to the industry has had a major positive impact on the growth and expansion of the U.S. industry over the past three years. As a result of the Consortium's research and technology transfer efforts, the U.S. became the first country to develop high health stocks and the first country to utilize these stocks as the basis for all production.

The review team recognizes that the development of high health seed production systems is the result of a well integrated multi-disciplinary, and multi-institutional program. The program involves the international acquisition of stocks, screening and quarantine of these stocks, development of certification procedures, improvements in maturation and hatchery protocols and facilities, stock evaluation, integration of animal health management practices, genetic diversity analysis, selective breeding, distribution of these stocks to the industry and evaluation of performance of these stocks under commercial production systems. The Consortium should be commended for the successful implementation of such a complex program.

FUTURE DIRECTION - FY 95 IMPLEMENTATION PLAN

The goals of the Industry Seed Supply for the FY 1995 plan are:

- 1) Continue the advancement of high health and genetically improved stocks for transfer and exploitation by U.S. commercial companies in domestic and export markets.
- 2) Provide design and operational guidance for the construction of a nucleus breeding center using non-USMSFP monies and a site acquired with non-USMSFP funds.
- 3) Execute a sophisticated breeding program including broad based evaluation of stock performance and disease resistance as well as production of a breeding manual.
- 4) Produce a series of detailed disease control and operation manuals for internal use and for distribution to the commercial sector.
- 5) Support commercial broodstock and seed production by providing seed for broodstock production and emergency backup broodstock, nauplii and seed supplies, and by assisting commercial start-up efforts.
6. Improve the design and operation of quarantine stations.

COMMENTS AND RECOMMENDATIONS

The review team noted that there has been substantial improvement in the consistency and productivity in the maturation and hatchery production technology within the Consortium. All

institutions involved in the hatchery and maturation components of the program have demonstrated excellent and dependable production. Artificial insemination techniques have also been refined. Improvements in maturation and hatchery facilities has also impacted the success of the program. In addition, the technology developed through the Consortium has also been successfully transferred to the private sector.

The implementation of the selective breeding program is on target and the expertise of the Norwegian fish breeding consulting firm has been utilized appropriately. The review team recommends that the Consortium continue to utilize this expertise in the implementation and review of the breeding program.

The Consortium has done an good job in the acquisition, screening, and quarantining of additional stocks. Development of certification protocols and guidelines appear to be appropriate. The Consortium realizes that it has no legal or regulatory standing relative to certification but that protocols developed are more in line with a voluntary animal health assurance program.

The basic research on nuclear and mitochondrial DNA fingerprinting for diversity analysis has been incorporated into the breeding program. Continued efforts in this area should enhance the breeding program.

The Consortium has documented seed and broodstock distribution to the private sector. It is clear that this effort has had a direct and significant impact on the industry. It is obvious that the industry is heavily dependent on the Consortium. The review team concurs with the Consortium's approach to have the private sector take on a more significant role in developing the seed supply for domestic markets, reducing the industry's reliance on the Consortium for seed and broodstock. Partnerships that would expedite the privatization of seed supply and stock improvement should be encouraged. The high health animal distribution model outlined by the Consortium is appropriate and parallels approaches used in other animal production systems.

As seed and broodstock are dispersed to the private sector, the Consortium should increase its rigor in the documentation of performance of animals under commercial conditions.

The review team concurs with the Consortium's perspective that future high health seed production programs should be directed at the development of specific pathogen free and specific pathogen resistant stocks.

The review team recommends that the Consortium continue to consider the development of a seed supply industry in the U.S. to serve international markets. The team support enhanced efforts in this area including the acquisition of additional stocks and species.

The review team recognizes that the nuclear breeding center is critical to the success of the program.

DISEASE CONTROL AND ANIMAL HEALTH ASSURANCE

BACKGROUND

Animal health management is probably the most important concern facing the shrimp farming industry worldwide. In recent years, viral diseases have had devastating effects on commercial shrimp farming in Southeast Asia, China, South America, and Central America. Although the U.S. shrimp farming industry has overcome

critical disease problems associated with the certain viruses (ie. IHNV), the industry still suffers chronic losses with other disease problems. Recently the Taura Syndrome Virus (TSV) which ravaged shrimp farms in South and Central America has been detected in Florida and Hawaii. With the spread of TSV and the potential for introduction of other highly virulent viral pathogens from Southeast Asia and China, it is critical to develop technologies and animal health assurance programs that protect the domestic shrimp farming industry.

In addition to protecting the cultured stocks of shrimp, it is also important to evaluate the potential impact of pathogens and health management schemes on native indigenous stocks. The Consortium has addressed this problem in a proactive mode. Studies to monitor wild indigenous populations for viral pathogens and potential impact of shrimp farming should provide a scientific base to address this issue in a rational manner.

PAST FINDINGS

In 1991, the review team noted that significant progress had been made in the development of shrimp health technology and that the Consortium had developed a strong team approach in this area. The development of the first SPF stocks was recognized as a significant step forward as well as the establishment of three cooperative shrimp disease research and control centers. The efforts to develop and use highly sophisticated diagnostic methodologies demonstrated Consortium leadership in this area of science. The overall improvements in the Consortium's capability to develop and implement disease control technologies were evident. Shrimp health activities were well integrated into other Consortium research activities. The team commended the Consortium for its proactive expansion of the research scope to evaluate and monitor impact of shrimp culture on indigenous species from a health perspective.

The team had recommended that a certification program be implemented and that performance standards should be developed, documented and routinely used to evaluate stocks. A coordinated effort to develop disease models for viral and bacterial pathogens was recommended. The team indicated that the development of the shrimp bluebook was extremely important and that the project should be completed.

The Consortium was encouraged to pro-actively define the health status of shrimp species native to the U.S. By defining the health status of native shrimps, any future disease impact from unintentional release of non-native species potentially being disease vectors could be more legitimately evaluated.

PRESENT FINDINGS

The Consortium has established itself in a world leadership position in the area of shrimp health management, particularly viral diseases. It has assembled an expert team and has applied state-of-the-art technology to improve health management procedures. The shrimp health management efforts are the cornerstone for other Consortium activities and substantial investments have been made in this area. Disease control and health assurance technologies developed by the Consortium are in demand in shrimp farming countries around the world and will impact world shrimp production.

There is excellent collaboration and communication within the Consortium and with the appropriate expertise around the world. The research and management approaches have been anticipatory allowing the Consortium to be responsive to global events in the

shrimp farming industry. Pioneering efforts in the area of diagnostic techniques has greatly accelerated the pace of development of new diagnostic tools for recently described pathogens.

The Consortium has been responsible for the identification and characterization of a number of commercially significant pathogens. Efforts to commercialize technologies developed by the Consortium are appropriate and should continue. Diagnostic and reference laboratory support provided by the Consortium has been essential to the industry.

The team feels that research quality in the area of shrimp health management is very good. The health management team has been highly productive and the program is on target. The success of all other components of the program is highly dependent on the progress made in this area.

FUTURE DIRECTION - FY 1995 IMPLEMENTATION PLAN

The scope of the FY 1995 Program is narrow and focused, and lends itself to cooperation and integration among the member institutions. All efforts will be monitored by the Coordinator to enhance the smooth and timely flow of information and foster the cooperation required to accelerate project completion and transfer the results to industry.

GOALS: The goals for this objective include the following:

1. Prepare and distribute a series of detailed disease control manuals for nucleus breeding centers, primary and secondary quarantine stations, broodstock multiplication, nauplii production, seed production and growout operations. These manuals will include procedures, protocols and health assurance guidelines.
2. Establish a shrimp health monitoring system that includes an integrated paper trail to track SPF shrimp populations and document the occurrence and remedial action required for all breaches in shrimp health status.
3. Characterize and develop molecular probes for the microorganism responsible for NHP disease in Texas. Maintain the INAD, providing limited authorization for the use of medicated feed to limit the impact of NHP.
4. Develop management and siting guidelines (non-drug means) to limit and perhaps avoid the impact of NHP, including environmental factors and reservoir/vector identification and interruption.
5. Develop and employ protective measures to limit the spread of TSV in the United States. Refine bioassay protocols and interpretation, and develop and evaluate a TSV molecular probe.
6. Identify sources of contamination and disease vectors for TSV. Evaluate imported live shrimp, frozen product and wild reservoirs as possible carries of TSV, and determine the effect of TSV on indigenous wild species.
7. Rigorously compare selected management strategies and environments under both laboratory and field conditions for the occurrence and severity of blackspot disease.
8. Study the pathology of blackspot, including lesion characterization and induction, to contribute to methods of prevention and/or treatment.

9. Continue the characterization, pathogenesis and methods of disinfection necessary to diagnose, prevent and/or treat bacterial diseases.

10. Refine health control methods developed for IHNV virus. This includes kit optimization, screening, pathogenesis and disinfection methods.

11. Respond to new disease outbreaks around the world that may either affect the U. S. industry or provide future opportunities for the export of U. S. technologies and products to foreign countries.

COMMENTS AND RECOMMENDATIONS

The team commends the Consortium for its rapid response to critical developments in the area of shrimp health management. The Consortium has provided global leadership in identification, characterization and diagnosis of important shrimp pathogens. The anticipatory nature of the Consortium's approach has positioned the U.S. appropriately. The crustacean health management team within the Consortium is widely recognized as the best in the world. The team has become more effective with the strengthening of expertise and facilities.

The Handbook of Diagnostic Procedures for the Infectious Diseases of Penaeid Shrimp (Blue Book) will be an important contribution to standardization of diagnostic methods worldwide. It should be published as soon as possible, even though subsequent revision will be required for some procedures.

The review team recognizes the major economic impact achieved in South Texas through control of NHP with oxytetracycline treatment. One pond producer increased average survival from 18% in 1993 to 55% in 1994. The team encourages the Consortium to pursue drug approval for OTC. The team strongly supports research directed toward alternatives to OTC, such as exclusion or environmental management of NHP.

The Taura Syndrome virus (TSV) is the most significant viral disease affecting the shrimp industry in the Western Hemisphere. The Consortium has been very quick to respond to the threat of TSV. After determination of the viral identity of TSV, the Consortium quickly developed a gene probe.

The team concurs that research efforts directed at the development of SPF/SPR (specific pathogen resistant) should be accelerated. In addition, management guidelines are needed for production of shrimp in virus-exposed environments. Such guidelines are likely to include use of viral resistant shrimp and minimal exposure management practices such as disinfection of water supplies and zero water exchange pond management. Without viral resistant stocks and a complete package of shrimp production technology, the marketability of Consortium shrimp stocks may be limited.

Herd Health Management program should be continued to provide a basis for integrating shrimp health management into the current production systems.

The transfer of commercial development rights for diagnostic tools to a private company is important to the commercialization of technologies developed by the Consortium and should be encouraged.

It is also critical that the disease control manuals under development are appropriate for laboratory and field applications. These include NBC, breeding and broodstock

multiplication efforts in Hawaii and stock evaluation, nauplii production, seed production and growout in South Carolina, Texas, Mississippi, Hawaii, and Florida. The disease control manuals must be compatible and consistent with the operational and breeding manuals being produced by, OI, WMC, and TAES.

The investigation of "new" penaeid shrimp diseases around the world is extremely important. The Consortium's effort to evaluate the potential impact of these pathogens on domestic and native stocks in the U.S. is critical and will assist producers and government agencies in evaluating future management and prevention strategies. The development of a research base and diagnostic tools for these pathogens should move forward.

ENVIRONMENTAL QUALITY

BACKGROUND

As the shrimp farming industry in the U.S. has expanded, concerns over the impact of effluents from shrimp farms on receiving waters has increased. Regulatory agencies responsible for monitoring effluent, in both Texas and South Carolina, have voiced concern over the amounts of nutrients exiting shrimp farms. In FY 1994 the Consortium initiated research in the area of environmental quality. Efforts were made to characterize the effluents, determine effluent treatability, and suggest treatment options. Best management practices will be developed that address pond bottom management, formulation of environmentally friendly feed, waste interception, and waste removal.

PREVIOUS FINDINGS

Since this research area was initiated in FY 1994, previous reviews did not address this research area. Although the Consortium has recently added this area of research to its program, institutions within the Consortium have been involved in this area of research in the past through other programs.

PRESENT FINDINGS

The Consortium objective is to minimize the impact of shrimp pond effluent on receiving water. Research has focused on reducing water exchange rates while maintaining super-intensive stocking densities. Some work has been done on characterization of pond effluent from commercial shrimp farms.

Considerable attention and funding have been redirected to studying effluent problems. The Consortium obviously realizes the importance of minimizing the impact of pond discharges on the environment as the future of the shrimp farming industry is threatened by the present regulatory climate. The review team recommends that this problem receive continuing emphasis regardless of the regulatory atmosphere. It is not clear that the problem areas have been adequately identified and prioritized. Much effort is being directed to investigating the contribution of soil type to TSS and nutrient concentrations, but the rationale for this approach has not been clearly defined.

Studies at WMC in intensively stocked ponds have led to reduced water usage without adversely affecting production. Some effort should be made to encourage local producers to adopt these water-saving practices.

FUTURE DIRECTION: FY-95 IMPLEMENTATION PLAN

ENVIRONMENTAL QUALITY OBJECTIVE:

Develop and transfer to the industry methods to improve effluent quality through various pond management strategies and shrimp farm design. Provide model water quality standards, for consideration, to state regulatory agencies in Texas, Hawaii, and South Carolina.

GOALS:

Develop and write model water quality standards for consideration by state regulatory agencies in Texas, Hawaii, and South Carolina.

Develop improved feeding methods to eliminate waste, reduce costs, and reduce nutrient load per unit shrimp.

Develop methods to control the growth of pest mollusks in ponds.

Develop pond management practices to substantially reduce water usage.

Develop water treatment methods to remove suspended solids and/or nutrients from the effluent stream.

COMMENTS AND RECOMMENDATION:

There is some repetition of planned research effort between the Waddell Mariculture Center (WMC) and Texas A&M University (TAMU) in the area of Best Management Practices (BMP). The effects of feed frequency, feed ration, and time of feeding on effluent quality are being studied at both places. Coordination of this research effort is needed to take advantage of the unique facilities at each location. TAMU is studying the effects of plastic-lined ponds while WMC has been working with plastic-lined ponds for several years.

The team realized that this is a relatively new area of research for the Consortium and the existence of undefined problem areas is understandable. In general, the team finds that the emphasis and direction of research is appropriate.

SHRIMP CULTURE TECHNOLOGY

BACKGROUND

Although the FY 1995 implementation plan does not contain a section on shrimp culture technology, the Consortium has conducted a significant amount of research in this area over the past three years. The review team did not conduct a detailed review of the research in this area since the last review. However, the team did consider previous activities and provided general comments.

PREVIOUS FINDINGS

Considerable experience in production technology had been developed within the Consortium over the past 3 years. The cooperating institutions had developed facilities and experience that permit culture of shrimp at densities sufficient for commercial production. An "Intensive Shrimp Production Technology" manual produced by OI provides specific guidelines and information for all phases of shrimp production, including maturation, hatchery, nursery and growout.

The maintenance of SPF broodstock was determined to be essential for the commercial extension of the existing technology, and special efforts must be employed to maintain the integrity of existing broodstock. Factors limiting production had been identified.

The team recognized that although many factors affect production, factors should be standardized wherever possible to facilitate interpretation among studies at the same and different institutions.

PRESENT FINDINGS

The consortium has developed and transferred commercially appropriate maturation, reproduction, hatchery, and nursery system technologies for the reliable production of high quality nauplii, postlarvae, and juvenile seed. The headstart nursery systems technologies have been successfully evaluated as well as co-culture production systems. Evaluation of maturation performance under three feeding regimes has been successfully completed.

Progress in this area of the program has been adequately documented in annual progress reports submitted to USDA.

COMMENTS AND RECOMMENDATIONS

The review team found that the de-emphasis of growout technologies is appropriate based on the current needs of the industry. The team encourages the Consortium to consider that as improved SPF/SPR stocks are developed that production strategies and management systems will have to be adjusted to optimize production of these stocks. Growout systems should be developed as part of an integrated technology package.

SUMMARY AND GENERAL FINDINGS

1. The review team was pleased with the overall Consortium management. Communication and cooperation among the scientists and professional staff at the various institutions is outstanding and has resulted in true team building. The activities of the various institutions are well integrated into the program and there is greater interdependence among the institutions within the Consortium.
2. The review team felt that the Consortium has done an admirable job in program planning and development. This has resulted in an improved sense of a shared vision and direction for the Program at both the administrative and technical level. Strong linkages with the industry in priority setting and implementation of the program has assured the relevancy of the program. The team found that The Consortium has been able to redirect programs and reallocate resources to respond to the needs and opportunities, and the declining resource base. The team finds that the reallocation and consolidation of Program efforts in the FY 1995 implementation plan are appropriate.
3. The team found that the overall productivity of the Consortium remained high. The overall quality of the research is excellent. Consortium members continue to publish extensively in peer reviewed journals and a variety of other publications. Consortium members have presented research findings at a number of national and international meetings. Research findings continue to be effectively communicated to the industry.

4. The review team recognizes that the Consortium has had a direct impact on the growth and profitability of the U.S. shrimp farming industry. Much of the growth of the industry can be directly and indirectly attributed to the development and transfer of advanced technologies, products and services by the Consortium. Close working relations with the industry have led to rapid adoption of technologies and products developed by the Consortium. The Consortium has provided a variety of essential services and products to the industry. Every shrimp farming operation in the U.S. continues to be dependent on supplies of high health broodstock and disease control and screening services provided by the Consortium. The team indicated some concern that the industry is almost overly dependent on the Consortium for products and services. The Consortium has also recognized this dependence and has adjusted its implementation plan to enhance the ability of the private sector to play a greater role in providing critical services.

5. The commitment of the Consortium to the development of high health seed linked to a sophisticated breeding program is a critical component of the Program. The review team recognizes that the development of the high health seed program was a tremendous and complex undertaking. High health seed or broodstock have been distributed to all U.S. producers resulting in a significant impact on the industry. The team endorses the Consortium's approach to the high health seed program and the allocation of resources to the breeding program. The use of the external consultants has been effective and should continue.

6. The review team recognizes the world leadership role that Consortium scientists have played in the area of shrimp health management and commends the research team for its commitment to excellence in this critical area of research.

7. The Consortium continues to provide comprehensive documentation relative to research accomplishments and services provided to the industry. The review team indicated that the Consortium could improve its documentation and analysis of the impact of the research findings and technologies developed through the program. The Consortium should think in terms of cumulative improvements and advances in technology packages that have been developed by the Consortium and utilized by the industry. The present reports do not capture the cumulative effects of research findings on particular technologies.

8. The Consortium continues to be well positioned to address the needs of the industry as a result of the anticipatory approach to seed supply and shrimp health programs. The team recommends that the Consortium continue this approach and remain flexible in order to respond to the dynamics of world shrimp farming.

9. As the Consortium develops high health improved seed it is important to realize that production systems must also improve to maximize the use of the improved seed. Improved seed must be compatible with the production systems utilized. As international markets for seed are addressed, the production systems must be evaluated as well. The review team does not recommend any reallocation of resources at this time. However, future implementation plans should address this important opportunity.

10. The review team recommends that the Consortium prepare an assessment of the potential impact of research activities on the environment, particularly as it relates to the introduction of nonindigenous pathogens. The Consortium should carefully evaluate research protocols to assure that potential pathogens

are not introduced to the environment as a result of the research activities.

11. The review team endorses the Consortiums exploration of alternative or additional species for future work. It is likely that there will be a continued global demand for a variety of species and specific stocks eventually.

12. The review team endorses the development of environmentally sustainable production systems. The team encourages integration of this effort with other programs and recommends that the Consortium continue to work with the industry in this area and encourage the industry to play a more significant role in addressing this issue.

13. The team finds that the Consortium has adequately addressed concerns and recommendations presented during the previous review.

REVIEW TEAM -US SHRIMP FARMING PROGRAM

MARCH 28-31, 1994

Dr. Meryl Broussard, Team Leader
Principal Aquaculture Scientist
USDA\CSREES
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Dr. Bill Simco
Professor
Department of Biology
University of Memphis
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LETTER FROM JOHN J. REDDINGTON, PRESIDENT, DIAGXOTICS

The Honorable Thad Cochran
Chairman - Subcommittee on Appropriations,
Rural Development, FDA and Related Agencies
Dirksen Building, Room 136
Washington, D.C. 20510

March 16, 1995

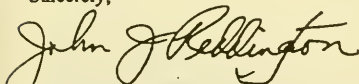
Dear Senator Cochran:

I am writing to you to voice my support for the continuation of funding for the US Marine Shrimp Farming Consortium. As background, I am the president of a small biotechnology business that is involved in developing and marketing, on a worldwide basis, health care products for use in aquaculture. We have already successfully transferred some of the technology that was developed by the Consortium into the marketplace. We have licensed DNA probes to several of the leading viral and bacterial diseases of shrimp that were developed by Consortium members (Dr. Donald Lightner, the University of Arizona, and Dr. Paul Frelter, Texas A&M University). There is a significant global need for the technologies that are being developed by the Consortium.

The technologies that were developed, and that we subsequently licensed, are extremely important diagnostic materials that are used to help control the devastating diseases that have plagued the shrimp culture industries throughout the world. We feel that these technologies have a multitude of beneficial effects to the US economy. Firstly, these diagnostic tools will help to maintain the health and profitability of the US shrimp industry. Although US production is small in terms of overall world production, the US is a significant supplier of disease free (High Health) seed stock to the Latin American industry. The diagnostic tools mentioned above are imperative to the supply of these High Health animals. Secondly, the technologies create new jobs in the US outside of the shrimp culture industry. As an example, we have hired 3 new technicians (high paying positions) to develop and manufacture the commercial products. For each new diagnostic probe that is developed by the Consortium, and that we are fortunate enough to gain Licensing Rights to, we will hire 1-5 new technicians. In turn, we will be buying reagents, packaging, and advertising materials for each of the commercialized products. Thirdly, much of our sales occur outside the US, therefore dollars flow back into the US economy. Lastly, we pay taxes on the revenues from the sale of these products, which returns money to the government for its original investment of funding to the Consortium.

I have been involved with the animal health care industry for over 20 years and I have never seen a more well organized, productive organization than the Consortium. They have targeted the most important aspects of shrimp culture that need investigation and have made tremendously valuable progress to overcome these problems. The investigators involved with the Consortium are extremely competent, hard working and productive. It is my sincere hope that your Committee will see and fully appreciate the overwhelming value of continuing the funding of the Marine Shrimp Farming Consortium. If you, or any of your colleagues, have any questions, or require additional information, please do not hesitate to contact me.

Sincerely,



John J. Reddington, DVM, PhD
President

LETTER FROM MARK ROSENBLUM, GENERAL MANAGER, MARITECH

The Honorable Thad Cochran
 Chairman-Senate Subcommittee on Appropriations, Agriculture, Rural Development,
 Food and Drug Administration and Related Agencies
 Room 136, Dirksen Building
 Washington, D.C. 20510

March, 29, 1995

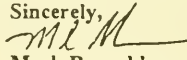
Dear Sir,

I am writing to you regarding the upcoming review of appropriations for the U.S. Marine Shrimp Farming Program. I have been involved in international marine shrimp aquaculture for the past 16 years. During that time, I have observed a significant advance in technological innovations and commercial successes which can be directly attributed to the achievements of the U.S. Consortium. As a group, they have been the "leading edge" in the industry for some time now, having accomplished most of their original objectives of creating a pathogen free race of shrimp and assisting the development of the industry worldwide.

The program though, has not quite finished its principle task of guiding this developing industry to a successful, self-sustaining status. Compared to other food production industries, an important amount of work and investigations remain to be performed before we can place shrimp farming among the other great American agro-industrial successes of the past.

I would also like to point out that the Program has widespread commercial implications on a hemispheric scale. Many shrimp farming industries of other Latin American countries also have learned to rely on information provided by the research accomplished by the Consortium. Although those foreign beneficiaries of the program's accomplishments are not sharing in the real costs of the program at this time, many are indirectly contributing in an important way to the US economy by purchasing raw materials, equipment, construction materials, expertise and continue to supply the market with high quality, reasonably priced product.

For these reasons, I strongly urge you to continue funding this important program.

Sincerely,

 Mark Rosenblum
 General Manager

LETTERS FROM BILL ENGLER, PRESIDENT, PACIFIC AQUAFARMS

Gary D. Pruder, Ph.D.
 Consortium Coordinator
 PO Box 25280
 Honolulu, HI 96825
 Phone: (808)259-7951

March 14, 1995

Dear Mr. Pruder,

My farm, Pacific Aqua Farms, has been associated with Dr. Donald Lightner and the U.S. Marine Shrimp Farming Consortium for over 3 years. The Consortium has supplied our operation with specific pathogen free SPF shrimp, technical expertise and disease testing services without which I would not engage in the shrimp business. Due to the consortium's support, Pacific Aqua

Farms is one of the few suppliers of SPF Penaeus Vannamei broodstock in the world sanctioned by the Consortium. When others have been blocked from entering product into foreign countries, our broodstock have been accepted. This is due to virus detection tests developed by the Consortium and the credibility and integrity which accompany each certificate of health given by the Consortium.

As a private American company, my farm obtains larval SPF stock from the Consortium. Pacific Aqua Farms then raises these larvae to juveniles which are tested by the Consortium for disease. Culture then continues until shrimp develops into suitable broodstock. Our shrimp are moved to other companies with the Consortium's bill of health.

Clearly the Consortium is integral to SPF shrimp culture worldwide, but especially for American companies as we work out the details of this young concept. The Consortium's efforts have already led to better understanding of controlling shrimp culture and my company has expanded jobs and markets as a result. I anticipate higher profits and continued diversification of any company as I continue to work with this Consortium. The Consortium has supported me unfailingly and in turn I heartily support its continued funding as I hope you do.

Joseph Skeen

Chairman - Subcommittee on Appropriations,
Rural Development, Food and Drug Administration and Related Agencies
Room 2362, Rayburn House Office Building
Washington D.C. 20513-6016

March 14, 1995

Dear Mr. Skeen,

My farm, Pacific Aqua Farms, has been associated with Dr. Donald Lightner and the U.S. Marine Shrimp Farming Consortium for over 3 years. The Consortium has supplied our operation with specific pathogen free SPF shrimp, technical expertise and disease testing services without which I would not engage in the shrimp business. Due to the consortium's support, Pacific Aqua Farms is one of the few suppliers of SPF Penaeus Vannamei broodstock in the world sanctioned by the Consortium. When others have been blocked from entering product into foreign countries, our broodstock have been accepted. This is due to virus detection tests developed by the Consortium and the credibility and integrity which accompany each certificate of health given by the Consortium.

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Sincerely,

Bill Engler

Bill Engler, President

LETTER FROM COLIN KALTENBACH, VICE DEAN AND DIRECTOR,
UNIVERSITY OF ARIZONA

Honorable John McCain
United States Senate
Washington, DC 20510-0303

March 30, 1995

Dear Senator McCain:

I understand Rush Limbaugh quoted you as saying that Arizona should not be involved in research related to shrimp production. Please accept my apologies for not keeping you more informed about this important program. I hope the following information will convince you that supporting shrimp research is in the best interest of Arizona and the entire nation.

Worldwide, shrimp production is a \$4 billion dollar industry. Importation of shrimp contributes significantly to our negative balance of trade each year. It is expected that development of this industry will decrease the trade deficit by \$500 million, contribute 25,000 additional jobs and generate an economic impact in excess of \$1 billion per year. Congress concurred with this notion some ten years ago when it initially provided support for the U.S. Marine Shrimp Farming Program (USMSFP), a consortium consisting of The Oceanic Institute (HI), Gulf Coast Research Laboratory (MS), Waddell Mariculture Center (SC), Tufts University (MA), Texas A & M University and the University of Arizona to accelerate expansion of an emerging domestic shrimp industry by removing major constraints to successful competition on the world market.

In 1994, domestic shrimp farming in the US registered its third consecutive year of profitable operations following ten years of general lackluster performance and financial disappointment. The economic impact of shrimp farming in the U.S. has increased from about \$22 million in 1991 to over \$65 million in 1994 and it is projected to exceed \$100 million in 1995. The number of jobs provided by the industry has already tripled.

Increasing industry profits and the resulting expansion are directly attributed to the adoption of technologies, products and services developed through the USMSFP. For instance, the U.S. is now a major exporter of high health and genetically improved shrimp broodstock and seed that were developed by members of the consortium. Major improvements in pond management techniques, effluent management and environmental enhancement have also been accomplished. Most importantly, the U.S. has become a world leader in shrimp disease diagnosis, prevention and treatment technologies. Thus, USMSFP, funded by congressional initiative, is accomplishing its stated goal of stimulating the expansion of commercial domestic marine shrimp farming in order to increase jobs, expand economic activity and reduce the U.S. trade deficit in shrimp products.

Unfortunately, work of the program is not finished. Private industries spawned as a result of the USMSFP remain dependent on that program. It is imperative that the Shrimp Farming program continue and expand to protect the viability of activities within the private sector.

Problems associated with disease remain as the single most limiting factor. Worldwide losses to the industry last year exceeded \$2 billion, much of which can be attributed directly to disease. For instance, the significant shrimp industry in Ecuador was almost completely eliminated by a newly identified Taurus virus. The worldwide losses would have been much greater were it not for the research efforts of the USMSFP consortium of which Dr. Don Lightner of the University of Arizona plays a pivotal role. His laboratory is one of only two designated international disease control centers for crustaceans. He is personally recognized as an international leader in development of diagnostic methods and other technologies that are absolutely essential for control of shrimp diseases. He has isolated and characterized no less than 7 of the viruses that have been identified as significant impediments to the industry. Just this week he successfully developed a gene probe for identification of the Taurus virus. This is our only hope for controlling this devastating disease that has spread throughout the Americas, including our own state of Hawaii. Because of this new advancement we have a good chance of preventing entrance of the disease to the mainland.

One might normally ask-- why are we supporting shrimp research in the desert? There is a very simple answer. Arizona provides an inherent isolation from shrimp production sites. It would not be in the interest of anyone, especially the industry, to conduct major disease research activities in coastal areas that might lead to contamination of pond production facilities.

Dr Lightner and The University of Arizona are making major contributions to the fledgling shrimp industry. It is realistic to believe there will be significant expansion of this industry but this will occur only if our leading edge research in disease identification and control is allowed to proceed.

Hopefully, you concur in this conclusion and will be willing to support continued Congressional support of the USMSFP.

Sincerely,



Colin Kaltenbach
Vice Dean and Director

LETTER FROM JAMES WYBAN, PRESIDENT, HIGH HEALTH AQUACULTURE,
INC.

The Honorable Thad Cochran
Chairman - Subcommittee on Appropriations
Room 136
Dirksen Building
Washington, D.C. 20510

April 7, 1995

Dear Mr. Cochran,

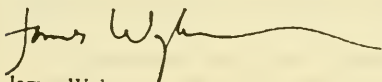
I am writing to you in support of the U. S. Marine Shrimp Farming Program (USMSFP). This program has conducted leading-edge research & development that has directly contributed to commercial success in U.S. shrimp farms. I know personally many farmers who would be out-of-business if not for the outstanding support the USMSFP has provided. The program's development of High Health shrimp directly lead to an increase of more than 140% of the U.S. shrimp farming industry's production over the last several years.

This program has been instrumental in creating opportunities for shrimp farming development. My small business was developed to commercialize technology developed by the USMSFP. We supply broodstock to the world's farmers that are offspring of the program's breeders in Hawaii. The USMSFP's development of state-of-the-art diagnostic procedures and health management systems have created several new business opportunities as well as saving many troubled farmers.

With their recent implementation of selective breeding, the program will create even further opportunities for U.S. firms in the future. This program is a success in the area of government-sponsored R&D.

I strongly urge you to continue to support the U.S. Marine Shrimp Farming Program.

Sincerely,



James Wyban
President

LETTER FROM STEVE CHAIKIN, OWNER, MOLOKAI SEA FARMS

The Honorable Thad Cochran, Chairman
 Subcommittee on Appropriations
 Rural Development, Food and Drug
 Administration and Related Agencies
 Dirksen Building, Room 136
 Washington D. C. 20510

March 10, 1995

Honorable Chairman:

My name is Steve Chaikin, owner and operator of Molokai Sea Farms, a marine shrimp farm on the island of Molokai, Hawaii. Our success has been primarily due to the technology transfer we received from the U.S.D.A. Marine Shrimp Farming Program at The Oceanic Institute. Without their assistance it would have been difficult to achieve profitability. Their recruitment and propagation of high health shrimp has provided the U.S. industry with stability for sustained growth. Their ability to provide genetically superior specific pathogen free broodstock is essential to the continued success of the industry.

I urge your support in maintaining and expanding the U.S.D.A.'s Marine Shrimp Farming Program. Their efforts in shrimp farming research especially in achieving high health and genetically superior shrimp are acknowledged and praised worldwide.

Sincerely,

Steve Chaikin
 Owner Molokai Sea Farms

 LETTER FROM CRAIG EMBERSON, GENERAL MANAGER, MAKUU
 AQUAFARMS

The Honorable Thad Cochran,
 Chairman- Subcommittee on Appropriations
 Rural Development, Food and Drug,
 Administration and Related Industries
 Dirksen Building, Room 136,
 Washington, D.C. 20510.

09 March 1995

To the Honorable Mr. Thad Cochran,

Makuu Aquafarms is a small commercial fish and shrimp farm south of Hilo on the Big Island of Hawaii. For the past two years we have concentrated on raising fish and shrimp to sell to the local market.

However, this year we wish to concentrate on raising High-health Penaeid shrimp broodstock to sell to US marine shrimp hatcheries and overseas.

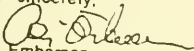
The Oceanic Institute has been very helpful in providing us with 96,000 disease free *Penaeus* nauplii from their SPF Kona quarantine facility. We were able to raise the post-larvae in our hatchery and stocked 47,600 juveniles to our outdoor tanks. We now hope to sell

these broodstock in the summer months. What is important is that we have now been able to secure disease-free, high-health shrimp stock through Oceanic Institute's efforts which we consider fundamental to the success of future shrimp farming activity in the world. We are very grateful for the technical support that we have received from the Oceanic Institute's staff and believe that financial support from the government should be continued in order to benefit farmers such as ourselves.

Thank you for your consideration and as a person with 22 years experience in aquaculture I firmly believe that US shrimp farming will become a profitable industry and deserves continued government support.

Thank you for allowing me to testify.

Yours sincerely,


Craig Emberson

General Manager

Makuu Aquafarms.

LETTER FROM AMUND UTNE, PRESIDENT, SHRIMP GENETICS HAWAII, INC.

The Honorable Thad Cochran
Chairman - Subcommittee on Appropriations
Rural Development, Food and Drug
Administration and Related Agencies
Dirksen Building, Room 136
Washington, D.C. 20510

March 22, 1995

Re: Continued funding for U.S. Marine Shrimp Farming Program FY96.

The truly scientific work behind the Special Pathogenfree Shrimp (SPF), the result of USMSFP and paid for by taxpayers, is the most beneficial program within US-aquaculture today.

SPF already holds the unique base for reaching the quieried subject. Solely the program's setting of different, updated and stricter defined quarantin standards, as an absolute precondition to meet for any supplier and recipient of SPF/High Halth broodstock for reproduction, will let the subject prevail.

Combined with a targeted development of an enhanced productive shrimp strain through ongoing selective crossbreeding, the return on the investment of the funding is guaranteed to be a healthier and faster growing shrimp, a species interesting for modern, industrial, high-tech investment and industrial production within the USA.

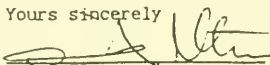
To establish such disease safety standard (DSS), and genetic development, it is necessary to call upon experienced aquaculture experts from successfully managed fields outside the primitive and diseaseplagued shrimp industry, i.e. from the more than 200.000 tons/year farmed salmon producer, Norway.

Diseases treathened the aquaculture industry there in the 80's, but strictly defined and managed DSS, and long term selective breeding improved the health and the production so significantly, that the use of medication over the last couple of years has been reduced by 95%.

Governmental funding also supported selective breeding, and now about 70% of the country's production is based on the strain from this program, which halved the grow-out time, lowered the FCR (Feed Conversion Rate) more than 40%, and made the industry world leader.

To get return on the funding already vested in the USMSFP, it is the best business decision to continue the funding of this unique successful Program, as it is on track and fully targets its objective in an updated way.

Yours sincerely



Amund Utne, President

LETTER FROM C. BRUCE SMITH, PRESIDENT, KAHUKU PRAWN CO., INC.

Honorable Thad Chochran
Senate Chairman - Sub Committee on Appropriations,
Agriculture, Rural Development,
Food and Drug Administration and Related Agencies
Room 136, Dirksen Building
Washington, D.C. 20510

April 7, 1995

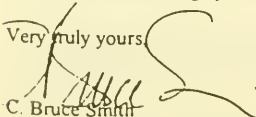
Dear Senator Chochran:

The Oceanic Institute (OI) is very important to us at the Kahuku Prawn Company. We have been in the aquaculture business for nearly 20 years. In the past several years, we have relied heavily on support systems provided by the personnel and facilities at OI. Specifically, they have helped us in the following areas:

- 1.) Shrimp maturation systems - In starting up our salt water shrimp business several years ago, they helped us design and debug our egg production system. Because of their continuing assistance, we are able to maintain an output of over 100 million eggs per year.
- 2.) Broodstock programs - Genetic strength and inventory support are two valuable services provided by OI. They have given us high quality start-up stocks and replacement stocks as needed.
- 3.) Health and disease management - One of the biggest problems in the shrimp business is disease. OI's high health broodstock program, their in-house pathology capability, and their comprehensive information system all work together to provide very important safeguards to companies in the field like ours.
- 4.) Fin-fish production - Fish are a means of protecting against the effects of shrimp diseases. OI has helped us with starter stocks and technical assistance in the production of Pacific threadfin fish, or Moi as they are known in Hawaii.

The Oceanic Institute, in our opinion, is a hands-on, heads-up organization whose people give rapid responses to important problems in the field. They have contributed in substantial and material ways to the success of our business, and the confidence we have for the future. We consider them to be highly worthy of your continued support.

Very truly yours



C. Bruce Smith
President

LETTER FROM RYAN S. MURASHIGE, VICE PRESIDENT, UWAJIMA
FISHERIES, INC.

The Honorable Thad Cochran March 31, 1995
Chairman - Subcommittee on Appropriations
Rural Development, Food and Drug
Administration and Related Agencies
Dirksen Building, Room 136
Washington, D.C. 20510

Mr. Chairman and Members of the Committee:

Uwajima Fisheries Inc. (UFI) is a commercial production and research facility since 1989. The first three years we have closed the life cycle of our primary product Japanese flounder, Hirame. We have established our own broodstock maturation, hatchery and growout protocols. From 1992, we have diversified into Ugo, Gracilaria sp., and two other local marine finfishes.

UFI has worked closely with the Oceanic Institutes shrimp program since 1990. We have obtained post-larvae from the SPF shrimp quarantine facility (Kona) for experimental growout and polyculture trials. Since then a quality control has been established as well as a strictly monitored quarantine protocol. At the present time UFI is a quarantine facility for the Penaeid Shrimp, Penaeus vannamei.

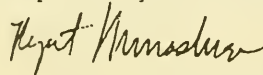
Since 1993, UFI has made a commitment to produce High Health Broodstock for U.S.A. and International Industries. The Oceanic Institute has unconditionally aided UFI in technical assistance regarding protocols of maturation, hatchery, nursery, growout and final growout of broodstock. This assistance has enabled the US shrimp producers to obtain productive high health broodstock for their hatcheries. In the past two years the shrimp program initiated and continued to monitor UFI shrimp health with scheduled testings.

At the present time UFI has two shrimp broodstock final growout ponds which will produce 2,500 animals per pond, twice a year, depending upon demand.

UFI's first harvest of broodstock shrimp was in the summer of 1994. From a harvest of 3,200 animals, we selected 2,700 for shipment. These shipments brought in revenues of over \$140,000. The first harvest of 1995 brought in 4,000 animals with revenues of over \$180,000.

UFI is one of the many private companies that has benefited from the technical assistance from the Oceanic Institute. Therefore, I would like to see this assistance continued.

Respectfully submitted,



Ryan S. Murashige
Vice President
Uwajima Fisheries Inc.

LETTER FROM HENRY R. BRANSTETTER, CONSULTANT

To: The Honorable Thad Cochran, Chairman
Senate Subcommittee on Appropriations
Room 136, Dirksen Building
Washington, D. C. 20510

Date: April 3, 1995

U. S. MARINE SHRIMP MARKETING PROGRAM

At its present rate of growth, the population of the U. S. will reach 285 million by the turn of the century while the world population will be 6 billion. Even now, supplies of many species of seafood for human consumption are declining drastically.

Shrimp is an exception-- as a result of aquaculture. Last year the U. S. imported over 600,000,000 pounds of shrimp with a market value estimated to be over \$3,000,000,000.00.

The U. S. Department of Agriculture stimulates domestic shrimp farming through Mississippi's Gulf Coast Research Laboratory and a consortium of U. S. research facilities headed by The Oceanic Institute in Hawaii, and the Department of Commerce supports shrimp farming research through the National Sea Grant College Program.

While shrimp farms are located chiefly in Hawaii, South Carolina, and Texas, other states are looking to qualify. Only through the sustained leadership of the U. S. Marine Shrimp Marketing Program will growth in U. S. shrimp production be likely. Through the accomplishments of the program, the U. S. shrimp industry has seen a 140% increase in production over the past two years.

I have been engaged in the shrimp industry for almost 50 years. I am a member of the National Fisheries Institute, World Aquaculture Society (including the U. S. Chapter), and the California Fisheries and Seafood Institute. Our country should go forward in shrimp production, and I am confident that it will go forward in accordance with the U. S. Marine Shrimp Marketing Program.

Respectfully,
Henry R. Branstetter
Henry R. Branstetter

LETTERS FROM HENRY C. CLIFFORD, III, PRESIDENT, C&C AQUACULTURE SERVICES, INC.

Dr. Gary Pruder
Consortium Coordinator
U.S. Marine Shrimp Farming Program
Oceanic Institute
P.O. Box 25280
Honolulu, HI 25280

May 22, 1995

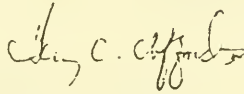
Dear Dr. Pruder:

In response to the request for testimony in favor of continued Congressional support for the USMSFP, published in the March issue of *Industry Briefs*, please find enclosed copies of two letters of support that I have sent to the respective Chairmen of the House and Senate

Subcommittees that apparently oversee the Program. I do believe that the USMSFP is making a substantial contribution to the development of advanced shrimp farming technologies, and I am happy to offer positive testimony in support of the Program.

Best wishes for continued funding.

Sincerely,



Henry C. Clifford III
President

May 22, 1995

Honorable Thad Cochran, Senate Chairman
Subcommittee on Appropriations, Agriculture,
Rural Development, Food & Drug Administration, & Related Agencies
Room 136
Dirksen Building
Washington, D.C. 20510

Dear Mr. Chairman:

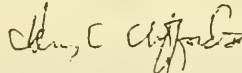
I am writing to commend and formally acknowledge my support for the **U.S. Marine Shrimp Farming Program (USMSFP)**, which operates with U.S. Dept. of Agriculture funding grants.

As an active member of the U. S.'s commercial aquaculture industry, my company provides technical and managerial services to existing and newly developing shrimp farming businesses in the U.S. and worldwide. We have successfully positioned ourselves at the forefront of shrimp culture's emerging technologies due in great part to technological advances developed by the scientists working in the **USMSFP**. A few of these advanced technologies that my company is currently utilizing in ongoing shrimp culture operations, are:

1. Highly sensitive, molecular diagnostic probes designed to detect minute quantities of important shrimp pathogens. These probes allow us to avoid or manage around potentially devastating disease epidemics.
2. High-health shrimp seedstock and broodstock, a concept pioneered in shrimp husbandry by **USMSFP** scientists.
3. New management practices for improving pond effluent quality and reducing effluent quantity, in an effort to augment long-term sustainability.

I have considerable exposure to the international aquaculture community, and I can proudly claim that, thanks to the research and development of advanced technologies by the **U.S. Marine Shrimp Farming Program**, the U.S. has a significant technological lead in commercial shrimp farming. Continued Congressional support and funding to the **USMSFP** is vital to maintaining our lead in the international shrimp farming industry. We are counting on your support.

Sincerely,



Henry C. Clifford III
President

LETTER FROM DAVID K. KAWAHIGASHI, RESEARCH BIOLOGIST, SAN
FRANCISCO BAY BRAND, INC.

The Honorable Thad Cochran
Chairman - Senate Subcommittee on Appropriations,
Agriculture, Rural Development,
Food and Drug Administration and Related Services
Room 136, Dirksen Building
Washington DC 20510

March 29, 1995

Dear Mr. Cochran:

As an active participant in the U.S. shrimp farming community for the past 18 years, I have repeatedly relied on the support and direction that the U.S. Marine Shrimp Farming Program has provided the industry. Unlike some governmental or university institutions, their research is more focused on the needs and requirements of the industry at all levels. This includes interaction and technology transfer in larviculture and maturation, intensive grow-out techniques, nutritional requirements, and disease control.

The nature of shrimp aquaculture in the United States and around the world is unique from other types of agri-farming. Shrimp farming is a very new industry when compared to the hundreds of years that land-based agriculture has been around (not to mention the degree of research invested). Although the emergence of shrimp farming has been rapid, its recent volatility as a "big business" industry worldwide reflects the lack of understanding and technology available to today's shrimp farmer. Although the U.S. shrimp farming industry will never grow to the proportions of South East Asia or South America, I feel that it is essential that we dedicate ourselves, through our U.S. Marine Shrimp Farming Program, to continue developing "state of the art" technology and the biological safeguards that the commercial producers will always overlook.

From a business (and political) point of view, maintaining a healthy U.S. Marine Shrimp Farming Program is an investment for the future. When the world has exhausted their natural resources, their environment, and been decimated by shrimp viruses and diseases, the U.S. shrimp farmers will be in the position to not only capitalize on the situation, but to take the technology to an even higher level. By the way, this is already taking place...

Yours truly,
SAN FRANCISCO BAY BRAND, INC.

David K. Kawahigashi

David K. Kawahigashi
Research Biologist

LETTER FROM CHARLES R. LARAMORE, PRESIDENT, SHRIMP CULTURE
TECHNOLOGIES, INC.

The Honorable Thad Cochran
Chairman - Senate Subcommittee on Appropriations,
Agriculture, Rural Development,
Food and Drug Administration and Related Agencies
Room 136, Dirksen Building
Washington DC 20510

Dear Honorable Thad Cochran

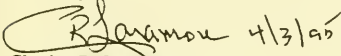
I am writing on behalf of the Gulf Coast Research Laboratory Consortium (GCRLC) to testify that we at Shrimp Culture Technologies, Inc. Located at Ft. Pierce, Florida would not be in the business of producing disease free shrimp broodstock and shrimp larvae for sale to shrimp

farmers in the United States, and elsewhere, if it were not for the assistance given by the Consortium.

Shrimp farming is big business world wide, with most of the shrimp consumed in the US being imported. We at Shrimp Culture Technologies, Inc. believe that a significant amount of shrimp can be produced in the US, given technical assistance from organizations such as the (GCRLC). Most shrimp farmers in the US are small businesses which have invested significant amounts of money and effort into shrimp farming. However, they are not large enough to make the technical breakthroughs, on their own, that will allow them to compete with foreign countries.

Small shrimp farmers are depending on help from GCRLC in order to survive.

Sincerely



Charles R. Laramore

President, Shrimp Culture Technologies, Inc.

LETTER FROM BOB ROSENBERY, EDITOR/PUBLISHER, SHRIMP NEWS
INTERNATIONAL

Dear Senator Cochran:

April 1, 1995

The United States Marine Shrimp Farming Program, part of the Gulf Coast Research Laboratory 'Consortium', has helped created a viable shrimp farming industry in the United States and has made the United States a leader in shrimp farming technology. This USDA-funded program is the country's brightest hope for resolving a \$2 billion a year deficit in imported shrimp.

Because of Consortium research, publications and seminars, shrimp farmers in the United States are the best informed in the world. And they are beginning to market products and services based on Consortium research. A company in Connecticut markets a virus test kit based on Consortium research. Shrimp hatcheries in the United States market 'Consortium-developed' high-health broodstock and seedstock around the world. Among the fifty countries that farm shrimp, the United States is the only one with high health stock. As this stock evolves, it will become increasingly valuable to an industry that already sees a large portion of its profits consumed by disease. In addition, dozens of United States shrimp farming consultants market Consortium-based technology around the world. These consultants are the best in the world.

With continued supports from the USDA, the shrimp farming industry in the United States will slowly nibble that \$2 billion deficit down to nothing!

Sincerely,



Bob Rosenberry
Editor/Publisher

LETTER FROM ROBERT T. EIFERT, OWNER, SHRIMP WORKS

The Honorable Thad Cochran
 Chairman - Subcommittee on Appropriations - Rural Development
 Room 136, Dirksen building
 Washington, D.C 20510

MARCH 29, 1995

Dear Congressmen Cochran:

Thank you for the opportunity to write regarding the importance of the U.S. Marine Shrimp Farming Program. I am the owner of Shrimp Works and started this business approximately one year ago. This company was started directly because of the opportunities related to the development of Disease Free Shrimp Stocks by the U.S. Shrimp Program. I have been involved in the aquaculture industry since 1980 and have invested most of my available income to produce and distribute disease free broodstock and seed stock to the shrimp farming industry. Most of these sales are international and contribute to a reduction in the trade deficit.


To date, Shrimp Works is responsible for the hiring of **5 employees** and converting an unused 10,000 square foot warehouse into an active ongoing business. Total expenditures to date are approximately **\$50,000**. If this money exchanged hands 7 times, (according to most economists), then the U.S. Shrimp Farming Program and I have contributed to a **\$350,000 investment/expenditure** over just six months into the local and national economy. Plans are underway for expansion of the aquaculture system if sales growth continues.

The direct support of Dr. Lightner at the University of Arizona and The Gulf Coast Research Laboratory in diagnosing and providing certification of disease free shrimp stocks has directly contributed to the development of this business. This support is still needed and deserving. Oceanic Institute has contributed as well through the supply of certified disease free seed to the industry, unfortunately it's continuing support, has recently been limited because of financial constraints.

The continued funding and development of the U.S. Marine Shrimp Farming Program is extremely important for the growth of this industry. Additional market acceptance and alternative shrimp species selection and supply of Disease Free Shrimp Stocks are critical for continued growth of this niche market. This "niche market" and income revenue potential is huge when you consider that shrimp is among the top two seafood products in terms of value and quantity consumed. This realization is only possible if programs are properly funded and supported by the U.S. Government. The entire shrimp farming industry looks to the U.S. marketplace for the latest technology, supplies, and support equipment. The U.S. marketplace is the only place in the world where a company can purchase or acquire Disease free Shrimp broodstock and seedstock. It is an important and expanding agribusiness industry.

I hope you and your colleagues will be able to provide a satisfactory level of funding and support to the Shrimp Farming Program that is so important to the aquaculture industry. Thank you for your time and understanding.

With best wishes,


 Robert T. Eifert
 Owner

LETTER FROM DAVID C. CANNON, PRESIDENT, EDISTO SHRIMP CO.

The Honorable Joseph Skeen
The Honorable Thad Cochran

29 March, 1995

Gentlemen:

I am writing to urge continued federal support for the U.S. Marine Shrimp Farming Program. This program has yielded valuable and practical results in recent years especially the "high health" broodstock program which has given the industry disease-free seed stock. Before this stock was available the industry was faced with financial failure due to poor performance of virus infected stock whereas now the industry is rapidly expanding. The shrimp farming industry in this country is embryonic compared to the state of development of other livestock. Much needs to be learned about nutrition, disease and genetics. Shrimp farming is probably where other livestock was 50 years ago in terms of the development of this vital knowledge.

A modest investment in continuing research can enable the industry to make inroads into the \$2.5 billion imbalance of trade in shrimp. The industry is expanding as rapidly as capital constraints will allow to increase domestic production which will decrease imports. We urge Congress to continue this invaluable program.

Yours truly,

EDISTO SHRIMP CO., INC.

David C. Cannon
- President

LETTER FROM HARFORD W. IGLEHEART, HOLLINGS & NETTLES, P.A.

The Honorable James Clyburn
319 CHOB
Washington, DC 20515

March 21, 1995

Re: U.S. Shrimp Farming Program

Dear Mr. Chairman:

I believe the prospects for the shrimp farming industry are very exciting. I foresee a significant, positive input to the local economy. I also believe that trawling has such an adverse impact on the marine environment that it will soon be considered unacceptable. I am very impressed with the work being done in the Marine Shrimp Farming Program. I encourage its continued funding.

Very truly yours,



Harford W. Igleheart

LETTER FROM JOHN J. HEWITT, DIRECTOR OF SALES AND MARKETING,
RANGEN, INC.

The Honorable James Clyburn
319 CHOB
Washington D.C. 20515

21 March 1995

Dear Congressman Clyburn:

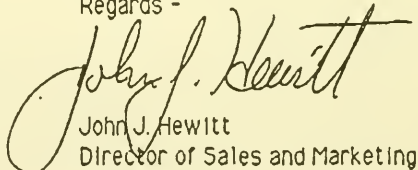
Rangen Inc. would like to draw your attention to the important work being done by the U.S. Shrimp Farming Program and to request your continued support for funding of this program by the USDA.

We feel that the research and information provided to the farmers by the U.S. Shrimp Farming Program are valuable tools which allow efficient and responsible growth and development of the shrimp culture industry. There are many areas where further research can result in significant improvements in productivity and efficiency. This will in turn allow for more effective management of resources and, in turn, long-term survival and expansion of the operation to provide more jobs and a broader economic base, as well as a valued end product.

We at Rangen have been involved in the shrimp aquaculture industry for many years, providing millions of pounds of quality shrimp feed annually. We feel that shrimp farming is a viable, productive industry with continued scope for growth and that it should be supported and encouraged. Our jobs, and those of our suppliers, benefit from the health of this industry, both at the original mill in Buhl, Idaho and at our new facility in Angleton, Texas.

Please support the USDA US Shrimp Farming Program and the continued development of this viable industry. Your support means the continued growth of a valuable industry and more jobs in a wide range of areas. If there are any further questions about the shrimp industry which I can be of assistance with, please do not hesitate to call.

Regards -



John J. Hewitt
Director of Sales and Marketing
Rangen Inc.

LETTER FROM TIM CZURA, REAL ESTATE BROKER

To Whom It May Concern:

March 28, 1995

I am a local real estate broker that represents most of the shrimp farms and various Aquaculture facilities in the state. I have sold four small shrimp farms over the years, and have brought in professional operators and investors which greatly improved the farms. These farms are employing local labor, and spending much money locally:

These facilities meet E.P.A. standards, and have proven to be clean and productive. The funding of the USDA shrimp farming program is very important to this industry. Waterfront land is generally very expensive, and I anticipate a slow moderate growth of shrimp farms along the coast.

Waddell Research Center is very professional and responsible about the potential environmental impact of shrimp farms and is a much needed support, and watch dog group.

Shrimp farms are unique to South Carolina, and can not succeed without the support of the USDA program.

Sincerely,

Tim Czura

LETTER FROM JAMES A. BATTLE, JR., PRESIDENT, SOUTH CAROLINA
AQUACULTURE ASSOCIATION

The Honorable Thad Cochran, Chairman
Subcommittee on Appropriations, Rural Development, Food and Drug
Administration and Related Agencies
Room 136, Dirksen Senate Office Building
Washington, D.C. 20510

March 24, 1995

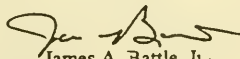
Dear Chairman Cochran,

I am writing today to ask your support for the US Marine Shrimp Farming Program which is funded by the USDA's cooperative State Research Service and conducted by the Gulf Coast Research Laboratory (GCRL) Consortium. This program is critically important to the continued development and expansion of the small but growing South Carolina shrimp aquaculture industry. In fact, without this program and the funding it provides to the state's Waddell Mariculture Center, it is doubtful that South Carolina would have the vibrant and growing commercial shrimp farming industry it boasts today. Further, without continued support by Congress for this program, it is highly likely that the industry will fail to reach its near-term growth potential. The industry alone simply does not have either the financial or scientific resources necessary to resolve the serious technological and policy problems that restrict its development.

The US trade deficit in shrimp alone exceeds \$2 billion annually, and there is no end in sight. South Carolina is a shrimp fishing state, but our domestic resource like that of the rest of the US is fully exploited. The only opportunity for increasing domestic production and thereby reducing this massive deficit is via the growth of the US aquaculture industry. And that requires the continuation of the US Marine Shrimp Farming Program. Therefore, I urgently request your support for continued funding of the US Marine Shrimp Farming Program via the US Department of Agriculture.

Thank you very much for your help.

Sincerely yours,


James A. Battle, Jr.
President

LETTER FROM D. LESLIE TINDAL, COMMISSIONER, SOUTH CAROLINA
DEPARTMENT OF AGRICULTURE

The Honorable James Clyburn
319 CHOB
Washington, DC 20515

March 23, 1995

Dear Representative Clyburn:

The US Marine Shrimp Farming Program, which is funded by the USDA's Cooperative State Research Service and conducted by the Gulf Coast Research Laboratory (GCRL) Consortium, is making very important contributions to the economic development of South Carolina and other coastal areas of the country. I write to solicit your support for the continuation of this program.

As you may know, aquaculture (the farming of seafood products) is the most rapidly growing area of American agriculture. It focuses on increasing the domestic production of seafood products with resultant reduction in the country's annual multi-billion dollar trade deficit in seafood. The specific goal of the US Marine Shrimp Farming Program is to create a vital, internationally competitive domestic shrimp farming industry that will increase shrimp production here and reduce our reliance on--and payments to--foreign suppliers.

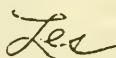
As a result of work of the GCRL Consortium's US Marine Shrimp Farming Program, South Carolina has begun to develop a multi-million dollar shrimp aquaculture industry. Working through the Waddell Mariculture Center locally, the shrimp farming program provides essential research and technical support services that underpin the emerging industry here. The Waddell Center works with the other participating institutions within the GCRL Consortium, thereby linking our industry to the best scientific expertise in shrimp aquaculture throughout the country.

In this program, dedicated scientists in Arizona, Hawaii, Massachusetts, Mississippi, South Carolina, and Texas work together to develop new and improved culture technologies and transfer these to the private sector. As a result of their efforts, the US shrimp aquaculture industry has realized dramatic increases in productivity, making profitability possible. It is also probably the most environmentally sensitive such industry in the world.

I believe that the small but significant shrimp aquaculture industry emerging in South Carolina can make very important contributions to this state's economic future. However, for this embryonic industry to realize its potential, it absolutely must continue to receive the kind of technical underpinning and R & D support provided by the Waddell Mariculture Center through its participation in the US Marine Shrimp Farming Program. I cannot overemphasize the importance of this research and technology transfer support. Private shrimp growers here have contributed their success to date in substantial part to the technological support provided by the US Marine Shrimp Farming Program through the state's Waddell Mariculture Center. I am convinced that without such support for a few more years, this industry would likely fail.

South Carolina, Texas, Hawaii, Puerto Rico and other areas are already benefiting economically from the development of commercial shrimp farms. It is my belief that continued Congressional support for this program will lead to a major increase in economic impact and job creation and greater domestic production of a highly valued consumer product. South Carolina needs this kind of farm diversification and economic growth, and I respectfully urge your support for continuation of this vital technology program within the USDA.

Sincerely,



D. LESLIE TINDAL

LETTER FROM JAMES A. TIMMERMAN, JR., DIRECTOR, SOUTH CAROLINA
DEPARTMENT OF NATURAL RESOURCES

The Honorable Thad Cochran, Chairman
Subcommittee on Appropriations, Rural Development,
Food and Drug Administration & Related Agencies
Room 136, Dirksen Senate Office Building
Washington, DC 20510

March 21, 1995

Dear Chairman :

I am writing today to ask your support for the US Marine Shrimp Farming Program which is funded by the USDA's Cooperative State Research Service and conducted by the Gulf Coast Research Laboratory (GCRL) Consortium.

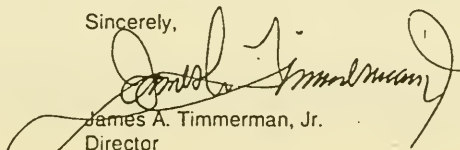
The GCRL Consortium has brought together the country's leading shrimp aquaculture research institutions, including our Waddell Mariculture Center, to jointly focus their resources and cutting-edge expertise on solving the pressing problems that impede the development of a strong commercial shrimp aquaculture industry in this country. As you may know, the US currently has more than a \$2 billion annual deficit in shrimp purchases, and this program is directed toward increasing domestic production through farming activities since our wild shrimp resources are fully exploited. Simply put, the goal of the US Marine Shrimp Farming Program is to create a competitive and robust domestic shrimp farming industry that can decrease our reliance on foreign suppliers.

Work by the program's dedicated scientists in Arizona, Hawaii, Massachusetts, Mississippi, South Carolina, and Texas has led to dramatic increases in productivity of domestic shrimp farming. For example, the economic impact and jobs creation effects of the industry nearly tripled from 1991 to 1993, growing from \$22.7 million and 550 permanent jobs to \$60.7 million and 1,448 jobs! These increases have occurred principally because of advances made by the US Marine Shrimp Farming Program and transferred to the private sector by members institutions of the GCRL Consortium, such as South Carolina's Waddell Mariculture Center.

As a result of the program's efforts, South Carolina has developed a modest marine shrimp farming industry and it is growing year by year. However, it does not yet have the technical underpinning necessary for it to grow and prosper long-term. The essential research, development and technology transfer support must continue to be provided by the US Marine Shrimp Farming Program. Success of private shrimp growers in South Carolina has been attributed in substantial part to the technological developments and close support provided by the State's Waddell Mariculture Center, which is a partner in the GCRL Consortium's US Marine Shrimp Farming Program.

With continued Congressional support for the program, it is possible that the economic effects of the US shrimp farming community could increase 10-fold or more. This kind of economic development, with its associated job creation, is vital to a number of coastal states such as South Carolina. South Carolina will have a bright future in commercial shrimp aquaculture, if funding for this crucial support program is maintained during this especially critical period of the industry's development. Therefore, I respectfully request your strong support for continued funding of the US Marine Shrimp Farming Program via the US Department of Agriculture.

Sincerely,

A handwritten signature in dark ink, appearing to read 'James A. Timmerman, Jr.', is written over a horizontal line. The signature is fluid and cursive.

James A. Timmerman, Jr.
Director

LETTER FROM WALLY AND EARLLEEN MEDLIN, SOUTH CAROLINA
SEAFARMS

GARY D. PRUDER, PH.D
THE OCEANIC INSTITUTE
PO BOX 25280
HONOLULU, HI 96825

MARCH 28, 1995

CONCERNING U S SHRIMP FARMING PROGRAM

WE THANK YOU AND ASK FOR YOUR CONTINUED SUPPORT OF THE U.S. SHRIMP FARMING PROGRAM BY THE SUBCOMMITTEE ON APPROPRIATIONS, RURAL DEVELOPMENT, AGRICULTURE AND RELATED AGENCIES, U.S. HOUSE OF REPRESENTATIVES.

THE U.S. SHRIMP FARMING PROGRAM WHICH IS FUNDED BY THE USDA IS OF PARAMOUNT IMPORTANCE TO THE S.C. SHRIMP GROWER. WITHOUT THIS FUNDING AND SUPPORT THE U.S. SHRIMP FARMING INDUSTRY COULD LOSE THE LARGE GROWTH IT HAS OBTAINED. IN THE NEAR FUTURE THE U.S. COULD BE A MAJOR SUPPLIER OF FARM RAISED SHRIMP TO THE U.S. AND OTHER COUNTRIES. THE ECONOMIC REWARDS MAY MEAN THOUSANDS OF JOBS AND A NEW INDUSTRY FOR THE U.S.

CONGRESSIONAL SUPPORT IS NEEDED TO FOR THE HIGH HEALTH SHRIMP STOCKS NEEDED FOR OUR INDUSTRY.

LAST YEAR WAS OUR FIRST SEASON IN SHRIMP FARMING HERE IN S.C. WE MOVED HERE FROM GEORGIA AND PURCHASED THIS FARM, HAVING NO EXPERIENCE IN AQUA FARMING, ABSOLUTELY NONE. WITH A \$300,000.00 INVESTMENT WE WERE VERY MUCH CONCERNED THAT WE WOULD NOT BE ABLE TO GET THE PONDS OPENED IN TIME FOR THE SHRIMP SEED. THE PROSPECT OF THE ACTUAL FARMING AND RAISING OF THOSE SHRIMP LOOKED BLEAK, ALMOST IMPOSSIBLE.

ENTER WADDELL MARICULTURE CENTER IN THE PERSON OF MR. AL STOKES. AL ASSISTED US IN ALL PHASES, STARTING WITH THE KINDS OF TECHNICAL INSTRUMENTS WE NEEDED AND HOW TO USE THEM TO ALL THE SPECIFICS OF OPENING THE PONDS SUCH AS TURNING THE GROUND, LIMING, PLANTING MEAL FOR PLANKTON GROWTH, FLOODING, WORKING WITH THE TIDES, LITERALLY ALL THE PHASES OF PREPARING THE PONDS WHICH ARE TO NUMEROUS TO LIST.

AL CAME TO THE FARM AT LEAST TWICE A WEEK UNTIL WE WERE READY TO FLOOD AND LIKE ALWAYS FULL OF INFORMATION AND KNOWLEDGE HE WOULD PASS ON TO US.

THE POSTLARVAE ARRIVED AT MIDNIGHT DURING A TERRIBLE LIGHTNING STORM, BUT AL WAS THERE. WITH A CREW OF 15 WET AND INEXPERIENCED SHRIMP ROOKIES AL TOOK CHARGE, WORKED HARDER THAN ANYONE AND WE SUCCESSFULLY PUT 1.3 MILLION BABY SHRIMP IN THE PONDS. PERSONALLY I BELIEVE AL PHYSICALLY PLANTED 1/3 OF THE CROP.

THROUGH THE ENTIRE GROWING CYCLE FROM APRIL TO SEPTEMBER, AL WAS THE GUIDING FORCE IN THE OPERATION OF THE FARM. WATER QUALITY, DO LEVELS, FEEDING SCHEDULES, GROWTH CHECKS, AND A THOUSAND OTHER PROBLEMS, AL WAS THERE TO SHOW US HOW. AT THE END OF EACH VISIT AL

WOULD ALWAYS MEET WITH US TO DISCUSS WHAT WAS BEING DONE, SOMETIMES THESE MEETINGS WOULD LAST FOR HOURS BECAUSE OF OUR MANY QUESTIONS. QUESTIONS THAT WE HAD PROBABLY ALREADY ASKED MANY TIMES BEFORE. WE WERE ALSO FURNISHED WITH ALL PRINTED TECHNICAL DATA FROM WADDELL.

HARVEST TIME WAS ALMOST A REPEAT OF THE OPENING OF THE PONDS. AL TOOK CHARGE AND SHOWED US HOW TO LOWER THE WATER LEVELS, WHAT EQUIPMENT WE NEEDED AND ASSISTED IN THE ACTUAL HARVEST, LITERALLY GETTING INTO THE MUD AND PHYSICALLY OUTWORKING EVERYONE. WE DID HAVE A SUCCESSFUL HARVEST THANKS TO AL AND WE HARVESTED ABOUT 33000 LBS WITH SALES OF \$83000.00.

HERE IT IS AGAIN, PLANTING TIME AND WE NEED TO CALL WADDELL AND SEE IF AL CAN COME UP WITH A SOLUTION AS TO HOW WE CAN GET THE PONDS READY WITH ALL THE RAIN WE'VE HAD THIS YEAR. I'M SURE HE WILL HAVE A SOLUTION.

I WOULD LIKE TO EMPHASIZE THAT WE WOULD NOT HAVE BEEN ABLE TO HARVEST A CROP OF SHRIMP LAST YEAR WITHOUT WADDELL AND THE SERVICES OF MR. AL STOKES. NO MATTER WHAT WE NEEDED OR THE TIME OF DAY OR NIGHT, MR. STOKES WAS THERE.

ALL THE PEOPLE AT WADDELL ARE SUPER NICE AND ALWAYS WILLING TO HELP. WE DON'T BELIEVE AQUA FARMING IN S.C. COULD EXIST WITHOUT THE HIGHLY TRAINED DEVOTED PERSONNEL FROM WADDELL MARICULTURE CENTER. THESE PEOPLE REALLY LIKE THEIR WORK IN AQUA FARMING AND THE RESEARCH THAT GOES WITH IT.

SINCERELY,

WALLY AND EARLEEN MEDLIN
SOUTH CAROLINA SEAFARMS

LETTER FROM GORDON MOBLEY, PLANTATION MANAGER, SPRING ISLAND
CO.

The Honorable Thad Cochran, Chairman
Subcommittee on Appropriations, Rural
Development, FDA and Related Agencies
Dirksen Building, Room 136,
Washington, DC 20515

April 5, 1995

Dear Honorable Thad Cochran:

I am writing this letter as testimony in support of the U.S. Marine Shrimp Farming Program (USMSFP). I have been raising shrimp for over 5 years and have greatly appreciated the assistance provided by this program. The success achieved by South Carolina Shrimp farmers has been attributed in large part to the technological developments and close support provided by the Waddell Mariculture Center, which part of the GCRL Consortium funded by the USDA. The GCRL Consortium comprises the country's leading shrimp aquaculture research institutions cooperating in a unique joint effort that focuses their high quality research, development and technology transfer expertise on solving practical problems impeding the development of a robust commercial shrimp aquaculture industry in the U.S..

The use of high health shrimp stocks has continued to be a great advantage for our pond production. As the wild stocks of shrimp become variable in quality, SPF captive stocks are increasingly important. Congressional support is vital to the increased and improved high health shrimp stocks needed for this industry.

The shrimp farmers of South Carolina thank you for your support in the past. We request your continuing support of the USMSFP by the Subcommittee on Appropriations, Rural Development, Agriculture and Related Agencies, U.S. House of Representatives.

Yours truly,

Gordon Mobley
Plantation Manager

LETTERS FROM RICHARD EAGER, SWIMMING ROCK FISH & SHRIMP FARM

The Honorable Thad Cochran, Chairman
Subcommittee on Appropriations, Rural Development,
Food and Drug Administration and Related Agencies
Dirksen Building, Room 136
Washington DC 20515

March 27, 1995

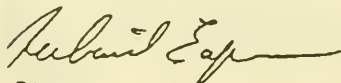
Dear Senator Cochran,

I believe in the downsizing of the Federal bureaucracy, and I believed in it even while I was a federal employee of the Fish and Wildlife Service. Especially I believe in restoring to the States control all power not specifically delegated by the Constitution to the Federal establishment. The U. S. Department of Agriculture funds the U.S. Shrimp Farming Program in part by allowing the States to experiment with increasing home grown marine shrimp through mariculture. South Carolina, through the efforts of the Waddell Mariculture Center, has done an outstanding job in advancing technical and product support to a blossoming industry.

High land shrimp farming in the United States creates jobs, generates tax revenue and reduces imports of high priced valuable healthful food. This industry is in its early stages of development here at home, but not very much technical work remains to be done to get it into the logarithmic growth stage. Then the Nation will greatly benefit from the rapid expansion in production that is possible, here at home. The consumer demand is there. It is evidenced by the high volume of imported cultured shrimp, with the concomitant great outflow of American dollars for this high priced product.

I encourage you to continue support for programs, like the USDA Marine Shrimp Farming Program, that are investments in American independence, while you cut wasteful Federal subsidy programs. It's good business. It's good government. It's what should be the definition of "political correctness".

Yours truly,


Richard Eager

The Honorable James Clyburn
319 CHOB
Washington DC 20515

March 27, 1995

Dear Congressman Clyburn

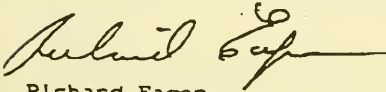
I am a shrimp and fish farmer in Meggett SC, and a concerned constituent. I am concerned that the fever to cut Federal programs will hurt South Carolinas' ability to fully develop its shrimp mariculture potential. This congressional district will be the center of great economic development in highland shrimp farming. The potential exists for many jobs and much money to flow through this aquaculture field.

As you know there already are several shrimp farms besides my own ten acres operating in your district. We farmers each "bet the farm" yearly on a good crop. Last year I managed to raise and sell about twelve thousand pounds of shrimp. This year I plan to increase that to twenty five thousand pounds. I've invested my life savings, and all I could borrow to go into business for myself. With continued success I will be hiring help so I can expand further. I am creating jobs and paying taxes, and not living off any farm subsidies.

I have confidence in what I do in great part due to the technical and product support I receive from the Waddell Mariculture Center. The U.S. Department of Agriculture funds the Marine Shrimp Farming Program, which in turn funds the Waddell Mariculture Center programs that help me help myself. I plan to further profit in part by helping others develop their land to produce profitable crops of fish and shrimp. There is much "heirs land" that lies in Hollywood, Meggett, Yorges, and Edisto Island that lies unproductive. It only awaits the right push, the right small scale demonstration, to bring rewards to the families that own the land.

Please do what you can to keep the USDA Marine Shrimp Farming Program from being cut. And please come visit my farm so I can share my vision for economic development of this areas abundant natural and human resources.

Sincerely,



Richard Eager

The Honorable Joseph Skeen, Chairman
Subcommittee on Appropriations,
Rural Development, Food and Drug Administration
and Related Agencies
2362 RHOB
Washington DC 20515-6016

March 27, 1995

Dear Congressman Skeen:

I'm no Forrest Gump, but I hope to do as well growing shrimp as that character did. Last season, my first as a shrimp farmer, I grew about twelve thousand pounds of the most

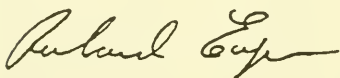
delicious shrimp I've ever eaten. And I managed to make a fair profit doing it, thanks in large part to the technical assistance and guidance of the South Carolina Waddell Mariculture Center staff. I plan to double my production in 1995, and have reinvested my profits into my farm business.

The State program that helped me earn a profit is supported in part by the Department of Agriculture's U.S. Shrimp Farming Program, which your subcommittee reviews for and determines funding level. I naturally pay taxes on my profits, as well as buy products and services which also are taxed. In this way I support the State of South Carolina program that supports me and the Department of Agriculture that supports both of us.

Shrimp farming is a new, exciting and rapidly growing segment of Agriculture. Aquaculture, and shrimp farming in particular, hold great promise for continued growth. This is good since it provides not only jobs at home, but at the same time reduces this nation's imports of foreign produce and the concomitant flow of dollars abroad.

In these times of cutbacks of Federal projects, it seems to me to make great sense to preserve those programs that generate jobs, cash flow, and tax revenue while reducing the Nation's balance of payments. I encourage you to support the Department of Agriculture's Marine Shrimp Farming Program and watch an industry develop before your eyes.

Sincerely,



Richard Eager

LETTERS FROM JEFFREY J. PETERSON, OWNER/MANAGER, TAYLOR CREEK
SEAFARMS

The Honorable Thad Cochran
Chairman - Senate Subcommittee on Appropriations, Agriculture, Rural Development,
Food and Drug Administration and Related Agencies
Room 2362, Rayburn House Office Building
Washington DC 20515-6016

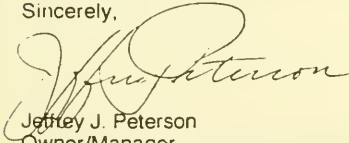
March 31, 1995

Dear Congressman Cochran,

I am a professional Aquaculturist with over 25 years experience in commercial aquaculture both in the U. S and overseas. Currently I operate a small marine shrimp farm in Ridgeland, South Carolina. I have had both the pleasure and good fortune to have personally witnessed the tremendous growth of this exciting and promising industry. A good measure of the recent advances in marine shrimp production technology can be directly attributed to the efforts of the U. S. Marine Shrimp Farming Consortium. Through a program of sound scientific leadership, guided by judiciously solicited industry input, the Consortium has enabled U.S. shrimp farmers to emerge as successful competitors in this global industry.

The consortium's efforts in disease management and production enhancement technologies have provided valuable tools for individual growers. But there are still many problems to overcome before shrimp farming can take its place among other forms of established animal husbandry. The continued presence of the Consortium at the forefront of these investigations is crucial to their success and I personally urge your approval of continued governmental support of this program. Thank you.

Sincerely,



Jeffrey J. Peterson
Owner/Manager
Taylor Creek Seafarms

Senator Strom Thurmond
SR-217
Washington DC 20515

April 20, 1995

Dear Senator Thurmond,

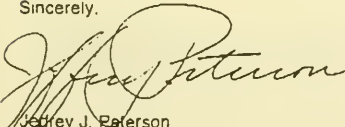
I am a professional Aquaculturist with over 25 years experience in commercial aquaculture both in the U. S. and overseas. Currently I operate a small marine shrimp farm in Ridgeland, South Carolina. I have had both the pleasure and good fortune to have personally witnessed the tremendous growth of this exciting and promising industry. A good measure of the recent advances in marine shrimp production technology can be directly attributed to the efforts of the U. S. Marine Shrimp Farming Consortium. Through a program of sound scientific leadership, guided by judiciously solicited industry input, the Consortium has enabled U.S. shrimp farmers to emerge as successful competitors in this global industry.

On a local level, the South Carolina Department of Natural Resources Waddell Mariculture Center has been a constant and reliable source of technical expertise and practical assistance.

There are currently twenty one shrimp farms in South Carolina. Total production has averaged approximately one million lbs/yr since 1993 and in 1994 the pond side value of the total crop was over \$2,500,000. Shrimp farming, in addition to revenue, provides jobs in rural areas, continues the agricultural legacy of South Carolina and positions the State as a national leader in this dynamic new industry.

The WMC's efforts in disease management and production enhancement technologies have provided valuable tools for individual growers. But there are still many problems to overcome before shrimp farming can take its place among other forms of established animal husbandry. The continued presence of the WMC at the forefront of these investigations is crucial to their success and I personally urge your approval of continued governmental support of this program. Thank you.

Sincerely,



Jeffrey J. Peterson
Manager
Taylor Creek Seafarms
and
President, South Carolina Shrimp Growers' Association

LETTER FROM FRITZ JAENIKE, PRODUCTION MANAGER, HARLINGEN
SHRIMP FARM LTD.

The Honorable Thad Cochran
Chairman - Subcommittee on Appropriations
Rural Development, Food and Drug
Administration and Related Agencies
Dirksen Building, Room 136
Washington, D.C. 20510

March 16, 1995

Dear Honorable Thad Cochran:

The United States Marine Shrimp Farming Program (USMSFP) has made a profound direct impact on shrimp aquaculture in Texas during the last four years. The advances with the commercial supplies of high health shrimp made possible with USMSFP funding through the Oceanic Institute, improved the performance and expected outcome of shrimp crops grown in Texas, and throughout the United States. Not only were crop yields improved, but in many cases the high health program made it possible to raise shrimp crops at all. A good example of the degree of impact the high health stocks have had for Texas were well illustrated in 1994. Southern Star Shrimp Farm, located in the Rio Grande Valley, was able to stock only one pond in 1994 because of a lack of high health seed stock since Texas has regulations in place which don't allow shrimp imports other than high health stocks. Southern Star could have potentially made 90 times the revenue last year which would have benefitted the local economy and employment greatly.

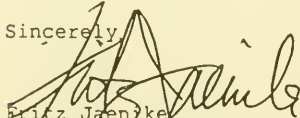
The USMSFP, through Texas A&M University and the University of Arizona, has had a key role in helping Texas farmers work with the FDA to administer treatments for NHP, a major cause of mortality and production loss in Texas cultured shrimp. Important research is underway to more fully understand NHP and ways to control its intensity through managerial techniques.

With USMSFP funding, TAMU has been able to play an active role in helping shrimp farms in the Rio Grande Valley of Texas characterize and evaluate farm effluent to find economically feasible ways to reduce environmental impacts. With the help of TAMU a water quality Laboratory was constructed and thousands of water samples were evaluated in 1994. Continued support will allow the farms to evaluate the treatment methods being employed which should be valuable information not only for Texas farmers, but for shrimp farms throughout the United States.

I feel the USMSFP has been a well directed effort to increase the economic feasibility of shrimp aquaculture in the U.S. Important ongoing projects will further enhance growth of the shrimp aquaculture industry in the U.S. to help offset the huge trade deficits in shrimp imports and to stimulate the economy.

Please continue to support this effort with Congressional funding.

Sincerely,


Fritz Jaenike
Production Manager
Harlingen Shrimp Farm Ltd.

LETTER FROM H.J. EWALD, JR., CHAIRMAN OF THE BOARD, RED EWALD, INC.

The Honorable Thad Cochran
Chairman - Senate Subcommittee on Appropriations,
Agriculture, Rural Development,
Food and Drug Administration
and Related Agencies
Room 130, Dirksen Building
Washington, DC 20510

March 29, 1995

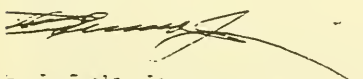
To The Honorable Thad Cochran:

Our fiberglass tank business with shrimp farms is solely dependent upon hatcheries. The hatcheries and the U.S. shrimp industry must have the SPF and/or high health shrimp to have good production and good profitability. Currently, the U.S. Marine Shrimp Farming Program is the only organization with the people and resources to develop good SPF and/or high health shrimp stock.

We thank you for your past support to the program, and we ask that the Subcommittee on Appropriations, Agriculture, Rural Development, FDA and Related Agencies continue its support of the U.S. Marine Shrimp Farming Program.

Sincerely,

RED EWALD, INC.


H. J. Ewald, Jr.
Chairman of the Board

LETTER FROM DA-CHYUAN YAO, RICHY INTERNATIONAL CORP.

The Honorable Joseph Skeen
Chairman-House Subcommittee on Appropriations, Agriculture, Rural Development,
Food and Drug Administration and Related Agencies
Room 2362, Rayburn House Office Building
Washington DC 20515-6016

April 1, 1995

Dear Congressman:

I am submitting this letter of testimony to you to indicate my strongest support to the U.S. Marine Shrimp Farming Program.

Last year was my third year of shrimp farming here in Arroyo City, Cameron County, Texas by using high health shrimp post larvae purchased from hatcheries reproducing broodstock and/or post larvae originated from the U.S. Marine Shrimp Farming Program. It proved that shrimp survival rate can be maintain at above 50%. For each of 5-acre ponds I operated, an average of 20,000 pounds of shrimp was harvested.

In terms of economical value for last year, production from each pond amounts to \$65,000 in average. With 3 ponds, I have been able to sustain three full-time employees and half dozen of part-time jobs. This was not achievable during 1990-1991 when shrimp post larvae from central and/or South America were used.

The U.S. Marine Shrimp Farming Program is not only successful in supply of high health shrimp post larvae to the farming industry but also help the industry to resolve effluent permit applications. The discharge permit application of the Taiwan Shrimp Village Association in Arroyo City, Cameron County, Texas to Texas Natural Resource Conservation Commission is one of the assistance program the MSFP has performed. With the importance of the MSFP in so many areas and a still shortage of post larvae supply, I pledge my firm support to this important program.

Respectfully yours,

D.C. Yao

Da-Chyuan Yao

LETTER FROM MIKE YATES, MANAGER, SOUTH TEXAS HATCHERY

The Honorable Thad Cochran, Chairman

April 6, 1995

Subcommittee on Appropriations

Rural Development, Food and Drug Administration and Related Agencies

Room 136, Dirksen Building

Washington, DC 20515

Dear Sir,

CONTINUED FUNDING FOR THE U.S. MARINE SHRIMP FARMING PROGRAM

I have been requested, by the Gulf Coast Research Laboratory Consortium (The Consortium) to submit direct testimony relating to the benefits and effectiveness of the U.S. Marine Shrimp Farming Program (MSFP). It is my great pleasure to do so.

Developments during the past year have reinforced my belief that our careful, sustainable, more technological and ecologically sound approach to aquaculture will pay dividends. The multi-billion shrimp aquaculture industry has already collapsed in several of the major producing countries. By contrast, the 1994 Texas harvest further proved the viability of shrimp aquaculture in this region. Consequently, I am now more confident of the prosperity of our industry and now predict a much accelerated

expansion. The Consortium's contribution in establishing the industry in the U.S. is now indisputable. Its potential future contribution is not only greater than previously imagined, but the level of certainty of its success is enhanced.

Our shrimp hatchery is located at Port Mansfield, close to the rapidly developing shrimp farms on the South Texas coast. Largely with the use of a Small Business Administration secured loan, we started construction of our facility in December, 1991. We now have 140 metric tons of larval rearing capacity and expect to double this capacity during 1995.

I was introduced to the objectives of the Consortium by Dr. Gary Pruder early in 1991. I was enthused by the potential of the developing technology and visited the Oceanic Institute's Hawaii facilities in September of 1991. I proposed to construct and operate a new wholly Specific Pathogen Free (SPF) shrimp hatchery in Texas.

Since my visit to Hawaii in 1991, the directors, staff and associates of the consortium have given me invaluable encouragement, advice, information and support. This has included visits by at least six of their specialists; "hands-on" technical advice, via fax and phone; annual seminars and frequent publications have helped to keep me abreast of new developments in the Consortium program, thus valuable information and experience, gained through the Consortium program has been passed on to us.

We have received five batches of high health broodstock from the Consortium. While ultimately, it is intended that private ventures should take over the Consortiums roll of supplying high health broodstock to the commercial hatcheries. To date, however, despite several attempts, no facility has been able to fulfill this roll. It is thus essential for the continued progress of the industry in the U.S. that the Consortium continues its broodstock production program.

The SPF program has been so successful that high health seed-stock has become the standard of the industry in the U.S. Our domestic clients (the shrimp farmers) as well as regulatory authorities now insist on high health seed-stock. New technology takes time to be accepted, however, foreign purchasers are likewise beginning to demand high health stock.

The Consortium's SPF and related programs have been very successful. Shrimp aquaculture production in the U.S. has improved dramatically as a result. I believe that the viability of the shrimp aquaculture industry in the U.S. is in fact dependent on technology developed by the Consortium.

While the SPF program (including disease diagnostic techniques) has been the main thrust of the Consortiums efforts, they are involved in several other issued effecting the industry. They have flexibility and are thus able to react swiftly to specific problem areas without requiring a protracted funding application cycle. They have therefore been called upon to spearhead new efforts, until other agencies are able to allocate resources thereto. This is particularly valuable in an infant industry in which technical and political bottlenecks can develop in a matter of months.

The work done by the Consortium also provides advantages to the U.S. aquaculture consulting industry. Specific knowledge of the new technology, together with the prestige derived by such research breakthroughs, keep U.S. consultants in world-wide demand.

From what I know of the proposed work of the Consortium, I believe that it has potential to further dramatically benefit the shrimp aquaculture industry, both domestically and world-wide.

I thank you for this opportunity to express my views on this very important program. If I could provide further input, please feel free to contact me.

Sincerely

Mike Yates

Mike Yates

Manager

LETTERS FROM YA SHENG JUAN, FARM MANAGER, SOUTHERN STAR
SHRIMP FARM, INC.

Dr. Gary D. Pruder
Consortium Coordinator
Oceanic Institute
Makapuu Point
P. O. Box 25280
Honolulu, HI 96825

April 19, 1995

Dear Dr. Pruder:

Enclosed please find 2 copies of letter I wrote to Senate and House committee for the funding of the Marine Shrimp Farming Program.

As a shrimp farmer, I really appreciate the work that Marine Shrimp Farming Program researchers have done. We need more information develop by the Program to continue to be a viable industry. If there is anything I can do to help, please don't hesitate to call me.

When you have the new policy for the cooperation with Consortium about the broodstock, please send me a copy and contact Mr. Stephen Yeh, president of our company, or I.

Thank you!

March 30, 1995

The Honorable Thad Cochran
 Chairman-Senate Subcommittee on Appropriations, Agriculture,, Rural
 Development, Food and Drug Administration and Related Agencies
 Room 136, Dirksen Building
 Washington DC 20510

Dear Honorable Thad Cochran:

I have been working with shrimp farmers in Texas since 1986, when I was a graduate student in Texas A&M University, working in a private shrimp farm collecting data for my dissertation. During the last 10 years, shrimp farming in Texas has changed a lot. Most significantly is for the last 4-5 years, shrimp farmer start to make money. The main reasons are, I think, the development of SPF stock and the research of disease control of "Texas pond mortality syndrome", both are funded by the Marine Shrimp Farming Program.

Before the SPF stock was developed by the Marine Shrimp Farming Program, shrimp farmer has to stock with a less desirable stock which grows slower and has a higher mortality. I had the chance to try the SPF stock in 1990 and 1991 in the farm I managed, the difference is day and night. The SPF stock out perform the regular stock by approximately 30%. This can be the difference of failure and success.

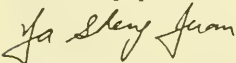
In the mean time, a disease "Texas Pond Mortality Syndrome" was bothering shrimp farmer in Texas. It has been identified since 1985. However, it was not until 1990, when under the funding from Marine Shrimp Farming Program, researcher from Texas A&M University found the cause and treatment method. The farm I managed increase the survival rate substantially in 1990 compare to that of 1989. This alone can also be the difference of success and failure.

Last year, the farm I managed now suffer a tremendous loss because our hatchery can not receive the SPF nauplii to produce the post larvae (baby shrimp) we needed to stock our ponds. To our farm, it means a 3 million dollar loss.

As you can see, the U.S. Marine Shrimp Farming Program has produced a lot of good results to help the U.S. Shrimp farming business. However, we need more information from the researches funding by the U.S. Marine Shrimp Farming Program to be a sustainable and profitable business to produce more domestic shrimp and cut down the billions of dollars of trade deficit from the foreign shrimp imports.

Your understanding and support of the U.S. Marine Shrimp Farming Program will be very appreciated.

Sincerely yours



Ya Sheng Juan Ph. D.
 Farm manager

LETTER FROM DR. ADDISON L. LAWRENCE AND DR. TZACHI M. SAMOCHA,
 TEXAS A&M UNIVERSITY

The Honorable Edmund Kuempel
 Texas House of Representatives
 P.O. Box 2910
 Austin, TX 78769

Dear Honorable Representative Kuempel:

Shrimp production from Texas farms was less than \$2,000,000 in 1990, with shrimp becoming the most valuable aquaculture crop in Texas in 1992. Actually, the value from shrimp farming was four times the value from all other aquaculture crops in Texas, in 1992. In 1994, the total value from the shrimp farm industry approached \$30,000,000 with an economic impact of nearly

\$90,000,000 with less than 4,000 acres of water in production. With millions of acres of land along the 1,425 mile coastline, much of which is not suitable for traditional agricultural crops, shrimp farming has the potential to rapidly expand in Texas and could generate revenues in excess of several hundred million dollars within ten years. The effluent waters generated by the shrimp farms currently create serious growth limiting factors for the emerging Texas shrimp farming industry. It is particularly true for Texas coastal areas, in which the discharge is going into bays and estuaries behind barrier islands that have limited water exchange with the Gulf of Mexico.

Over a Decade, the Shrimp Mariculture Project of the Texas Agricultural Experiment Station in Corpus Christi, has been the leading research institute addressing different aspects affecting the shrimp farming industry in Texas. In recognizing the importance of research and development needed to support this industry, Texas A&M University System has recently provided new and renovated top-of-the-line research and demonstration facilities with a cost approaching three million dollars.

The Texas A&M University System through the Shrimp Mariculture Project of the Texas Agricultural Experiment Station has recognized that maintaining desired aquaculture farm water effluent quality and environmental quality of the bays and estuaries has one of the three highest priorities of Texas A&M University System's research and development program. To obtain the desired water effluent quality and to reduce potential negative impact from shrimp farms' effluent on coastal waters, the Texas Agricultural Experiment Station has been conducting, for the last two years, a wide range of studies to characterize and estimate the impact of this effluent water on the environment. To facilitate data collection, a water analysis lab was built on one of the farm sites. Though the lab was designed and supervised by scientists from the Texas Agricultural Experiment Station and Texas A&M University, Corpus Christi, the total cost for the construction for this laboratory was paid for by the shrimp farms in the Rio Grande Valley. To ensure high quality data, the lab is using mostly EPA-approved sampling procedures.

Data collected during the 1994 growing season helped us to characterize the shrimp farms' effluent water. Based on the information collected, a massive testing plan was developed for the 1995 growing season to evaluate cost-effective methods to reduce environmental pollution from shrimp farms' effluent water. This research will require a team work of scientists from several research institutions in the U.S. To ensure validity of the data from the studies on the farms' sites, controlled experiments will be conducted at the Shrimp Mariculture Project of Texas Agricultural Experiment Station facilities at Corpus Christi.

It is important to recognized that the Shrimp Farms in the Rio Grande Valley spent several hundred thousand dollars in support of this research and development program. This support is continuing in 1995 and with additional support from feed companies such as Cargill.

In an effort to reduce the nation's annual two billion dollars deficit in seafood import, the United States Department of Agriculture through the Marine Shrimp Farming Program (USDA-MSFP) has launched an extensive research program to strength the U.S. shrimp farming industry. Beside Texas A&M University System, the Consortium consist of another five research institutions (Oceanic Institute in Hawaii, Tufts University in Massachusetts, Waddell Mariculture Center in South Carolina, Gulf Coast Research Lab in Mississippi, and the University of Arizona) which have ongoing research to help develop a sustainable shrimp farming industry in the U.S. The U.S. Shrimp Farming Consortium has also recognized that maintaining desired shrimp farm effluent quality is one of the three top priorities for shrimp research and development in the U.S.

The Shrimp Mariculture Project of the Texas Agricultural Experiment Station is fully committed to support the Texas shrimp farming industry by the development of cost-effective methods to reduce potential environmental negative impact from the farms' effluent water.

We feel that the Aquaculture Bill (HB2316 by Saunders) can provide the aquaculture industry the help needed to develop the knowledge and technology necessary for continued development and growth of a sustainable shrimp farming industry in our state. A shrimp farming industry which will be of a tremendous economic benefit to our state and at the same time be environmentally responsible and compatible. In fact, it is very feasible that the shrimp farming water effluent may actually improve the environmental quality of the Texas' bays and estuaries.

Please let us know if you need more detailed information.

Thank you.

Dr. Addison L. Lawrence - Professor and Project Leader

Dr. Tzachi. M. Samocha - Associate Professor

PANEL TWO

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD BY MISSISSIPPI STATE UNIVERSITY

Cooperative Extension Service Mississippi State University

TAB A

Executive Summary

One of the unique features of the Cooperative Extension Service at Mississippi State University is the partnership arrangement that exists among the federal, state, county, and private sectors. When the Smith-Lever Act was passed in 1914, this partnership paved the way for the combining resources to meet the needs of local constituents. The federal partner recognizes the need to continue its support of Extension so needs of national prominence can be addressed within states. The state, county, and private sectors continue to provide support that is used to address state and local needs, as identified by advisory groups and other key supporters of the Extension System.

The total Cooperative Extension Service budget is approximately \$31 million. Of that \$31 million, approximately 32 percent is federal funding. Agriculture and natural resources, family and consumer education, enterprise and community resource development, and 4-H youth development are Extension's ongoing priorities or "base programs." The federal base funding is approximately \$6 million. These funds are dispersed among 190 county Extension agents, 120 specialists, and other key support personnel. The remaining federal funds (approximately \$4 million) are in restricted funds used for specific efforts. For every one dollar of federal funding, the state and county partners contribute two dollars, plus county facilities and operational budgets provided at the local levels. The leveraging of federal funds has been successful and has enabled Extension to address issues that would not be possible without federal support.

Base Programs

Base programs are the major educational efforts central to the mission of Extension and common to counties. The base programs are the ongoing priority-program efforts of Extension, involving many discipline-based and multidisciplinary programs. They can be thought of as the foundation of a building, while the priority initiatives rise from the base to receive special emphasis for a period of time.

As stated earlier, base funding represents approximately \$6 million. Any cuts in these base programs would significantly impact Extension's capability to address a coordinated, comprehensive Extension program in Mississippi. These programs represent national interest, and Extension in Mississippi has made

wise use of these dollars in addressing critical statewide issues. Following are the educational base programs of Extension.

Agriculture and Natural Resources

Extension's Agriculture and Natural Resources Program charge is to provide practical and useful research-generated knowledge and technology to individuals, farmers, agribusiness, and natural resource managers. Educational programs are conducted to enhance the ability of individuals and groups in making decisions for improved agricultural profitability and the wise use and management of the Mississippi's natural resources. Extension strengthens the competitiveness of Mississippi agriculture and forestry through securing the adoption of new knowledge and technology that will lead to efficiencies in marketing, distribution, and production of food and fiber products. The overall goal is to assure an abundant and safe supply of products for U.S. and worldwide consumers. These programs are carried out by well-trained county agricultural agents in all 82 counties, backed up by highly competent area and state subject-matter specialists who have access to the latest research knowledge and technology from a land-grant university. Programs are carried out using a variety of methods, including one-on-one problem solving, computer software programs, group educational meetings, demonstrations, and mass media.

Enterprise and Community Resource Development

Enterprise and Community Resource Development is designed to bring the resources and expertise of the Food and Fiber Center, Community Development Department, Center for Governmental Technology, Energy Extension Center, and Extension Geographic Information System Unit into a cohesive effort to assist the people of Mississippi in enhancing their abilities to develop and expand communities, agribusinesses, the economy, governmental effectiveness, and environmental awareness. Assistance is provided in the form of educational programs, technical assistance, and technology application related to the problems encountered by entrepreneurs, farmers, agribusinesses, local governmental officials, community leaders, and organizations. These programs are carried out through a staff of state specialists and a network of county Extension offices staffed with trained professionals who have access to the resources of a land-grant university, and by working partnerships with statewide organizations and government agencies.

Family & Consumer Education

Educational programs help families and individuals develop skills to nurture, support, and guide family members throughout their lives to grow in economic security and to contribute to and be supported by caring communities. Through preventative education, individuals and families are empowered to make informed decisions about food and life styles that support their physiological health, economic, and social well-being. This intensive set of programs engages individuals in positive learning experiences for family preservation. F&CE educational programs are the foremost statewide nonformal educational programs that address the most pressing economic and social issues facing individuals and families.

4-H Youth Development

The 4-H educational programs focus on building lifelong learning skills that develop youth potential. This extensive set of programs engages youth in positive experiential learning, increasing their self-esteem and problem-solving skills. Programs address agricultural sciences, natural resources and wildlife, family and consumer education, food and nutrition, clothing, health, decision making, communication, personal development, and careers. A wide range of content offerings encourages youth to explore leadership skills, science and technology, community service, and citizenship. Volunteer leaders are trained to work with youth, age 5-18. Delivery methods include: community-based clubs, short-term special interest clubs, school enrichment programs, afterschool child-care sites, individual study, camping programs, and television series.

Examples of Base Programs Impact

- 109,199 youth, ages 5-18, participated in the Mississippi 4-H program last year
- 3,222 4-H volunteer leaders estimate about \$5,400,000 as their value of the total time devoted to 4-H plus their out-of-pocket expenses
- More than 15,516 youth completed animal science projects, with over 3,000 youth exhibiting horse projects
- 51.8 percent of the total youth are from minority racial-ethnic groups
- 145,330 4-H projects were completed by youth enrolled in one or more organized units
- 772,816 consumer-related contacts were made during the year
- 3,000 dislocated workers were reached with financial management information through Rapid Response Teams

- 2,409 child-care providers each completed 5 hours of education
- 5,400 Mississippi Homemaker Volunteers - resources leveraged - \$4,850,000
- 5,000 limited-resource consumers received nutrition education
- Agribusiness industries ranked in the top six industry categories in jobs created and capital invested for new and expanded operations in Mississippi
- Supported agribusiness clientele with over 450 firms receiving technical assistance or informational support while conducting 59 economic analyses and feasibility studies for new and expanding agribusinesses
- The agricultural and agribusiness sector is the most significant contributor to Mississippi's economy
- Farm income in 1995 exceeded \$4.3 billion with approximately \$18 billion in total economic impact including value-added processing and marketing
- Over 53 percent of all manufacturing jobs are in agribusiness related industries.
- Supported economic developers, resource planners, and governmental leaders through geographic information
- Extension specialists helped more than 3,500 county and municipal officials learn to more effectively manage their units of government through over 60 different educational programs for 13 different city and county officials groups
- More than 1,000 local officials participated in 3 local government certification programs
- Extension television and radio programs reach over 240,000 citizens weekly with agriculture and natural resources educational information

National Extension Priorities and Specified Programs

Sustainable Agriculture Systems

The overall goal of the Sustainable Agriculture Systems program is to make Mississippi agriculture profitable more environmentally sound, and socially acceptable as we move close to and into the 21st century. This joint effort between the Cooperative Extension Service at Mississippi State University and the Alcorn State University Cooperative Extension Program defines sustainable agriculture concepts, identifies sustainable agricultural interest groups, conducts training, and develops educational materials. Extension and the Mississippi Agricultural and Forestry Experiment Station will develop a survey of existing sustainable agriculture practices statewide to gather base line data to measure the impact of future sustainable agriculture programs. Extension programs support 7 agricultural commodity areas that rank in the top 10 nationally.

Integrated Pest Management

Integrated Pest Management (IPM) programs are used on virtually all Mississippi commodity crops such as cotton, soybeans, rice, corn, wheat, and greenhouse tomatoes. Management strategies within the program are tailored to problem areas in the various commodities. Major educational efforts are targeted toward county agents, producers, consultants, and industry personnel. In cotton, IPM practices have resulted in increased yields amounting to \$50 per acre and reduced costs of \$40 per acre. The total economic impact of IPM programs in cotton amounts to \$112 million statewide.

Pesticide Applicator Training

Changing trends toward improved water quality, environmental contamination, and preservation of human health established an urgent need for initial and recertification training of pesticide applicators to meet their ever-increasing requirements. Approximately 4,900 pesticide applicators were trained by Extension, joining over 20,000 persons who were certified and need to be retrained every 3 years. Additionally, the Worker Protection Standard regulation has increased the amount of training necessary for workers exposed to pesticides. Approximately 15,000 state workers and pesticide handlers were trained through worker protection pesticide standards program. Since its creation in 1970, the Mississippi Pesticide Applicator Training Program has met the educational challenges of this issue with initiation of School IPM, Pesticide Container Recycling Program, Ag Chemical Groundwater Monitoring Program, and Internet-accessible information.

Pesticide Impact Assessment

The Mississippi Agricultural Pesticide Impact Assessment Program conducts commodity/pesticide assessments to develop information for pesticides and important pest problems before regulatory actions are formally proposed. Impact assessments in watermelons, soybeans, sweet potatoes, are examples of crops evaluated. These assessments can assist EPA's required review by providing early regulatory

options and risk-reducing strategies. Questionnaires, surveys, and farm visits are used to defend the use of certain products and to prohibit cancellations in some instances.

Farm Safety/AgrAbility

The Farm Safety program is directed towards training and cooperative efforts with other agencies to increase awareness of citizens concerning farm safety hazards, and thus, ultimately reduce the number of farm accidents and deaths. Video tapes, publications, newsletters, news articles, media interviews, and public service announcements are the avenues that have been used toward this farm safety effort. The Farm Safety Program made 2,511 contacts in 1995. Specific emphasis was made on safety training for cotton module builders. This program was emphasized as a result of two deaths and several injuries attributed to cotton module builders in the mid-south.

Renewable Resources Extension Act

Renewable Resources Extension Act (RREA) funds support the development of short courses for forest landowners. These short courses provide intensive training in a structured format. Results of short course evaluations indicate that the RREA funds invested have resulted in a ten-fold return in federal tax revenues. A key to success of these programs has been the linkage between landowner groups and Extension personnel. Programs positively impacted landowners of 725,000 acres of forestland with information valued in excess of \$7.5 million when used by landowners.

Water Quality

This program is designed to inform the public about the importance of preserving quality in drinking water and surface waters of Mississippi. An estimated 800 farmers and more than 10,000 young people have received information about the importance of protecting water resources in Mississippi. More than 280,000 pounds of agricultural pesticides have been safely disposed of through the Waste Pesticide Disposal Program.

Telecommunications and Information Technology

Extension explores new technologies for creating, gathering, and disseminating information and in training others in using the technologies. The Dietary Analysis Project has enabled county Extension professionals to provide nutritional assessment and intervention practices for low-income, high-risk populations. The project has worked closely with the Rural Health Care Corps, especially in developing and using the interactive video conferencing system called the "Community College Network." This has greatly increased the ability to work with personnel from remote portions of the state to design and implement better health-care procedures and options.

The Internet is the tool of the future. Mississippi Cooperative Extension is exploring possibilities of delivering all of its publications and many programs to the public via the Internet. Extension has a goal to have all its publications available on the Internet for immediate access at any time. The lives of practically all Mississippi citizens has been affected positively in some manner through the efforts of this project.

Food Safety and Quality

Through a competitive process, the Mississippi Cooperative Extension Service received a grant to teach food safety and quality/food safety for child caregivers and restaurant personnel. About 2,406 individuals, representing 447 centers completed the 2.5 hours of food safety training in food safety and nutrition education. In addition, over 424 commercial food service employees each received 6 hours of intensive food safety training.

Expanded Food and Nutrition Education (EFNEP)

The program provided nutrition education in 29 counties to families with limited resources. Ninety-two EFNEP program assistants taught basic nutrition education to over 3,350 homemakers, 22,459 family members, and 10,868 preschool and elementary schoolchildren.

Youth at Risk

Three "youth-at-risk" grants from CREES/USDA were awarded to the Mississippi Cooperative Extension Service through a competitive process. The Afterschool child-care grant serves youth in Greenwood and Fayette. Project SOARS is an enrichment program in the Oktibbeha County Schools. Project GESTALT provides youth in the Jackson Public Schools an opportunity through afterschool programs to learn through experience. Each project targets youth who have numerous risk factors, and the programs' evaluations proved they have been successful. Over the past five years, over 3,500 youth have been involved in these three programs.

Rural Health and Safety Education

The Mississippi Rural Health Corps Project has operated in Mississippi since November 1992 and has evolved into an active influence in Mississippi communities, organizations, and families. The three area health agents of Cooperative Extension funded through this project, and supported by the State Health Education Specialist, have facilitated the development of a broad collaborative network of health education services. The major impacts have been to develop several community-based health councils, 16 community rural health coalitions, and to provide health education on 15 topics to an average of 2,200 people each month.

Nutrition Education Initiative/Healthy Babies

The ES/WIC Nutrition Education Initiative was given the title BabyTALK and implemented in three delta counties. Educational programs designed for pregnant teens addressed subjects such as low birth weight babies, inadequate health care, undernutrition of children and school dropouts. Improvements were noted in 80 percent of the teens participating in the program.

Reservation Extension Agent

Youth educational programs addressing issues such as nutrition, teenage pregnancy, drug abuse, importance of the environment and natural resources are carried out through the school system. Learn by doing skills relating to gardening and working in harmony with the environment are taught to youth through hands on projects in outdoor classrooms. Over 500 elementary school children have participated.

In agriculture, a farmer's market has been established with approximately 30 acres set aside the planting and growing fruits and vegetables to support the market and provide fresh vegetables and fruits for family consumption. A new facility has just recently been established with funds generated from grant sources to support the farmer market needs. Each year a field day is held on the Reservation with over 1,000 individuals participating. The field day allows for demonstrations on planting, growing, and marketing techniques, preparation of fresh vegetables and fruits for consumption and youth activities on the importance of environment.

Rural Development Centers

Established jointly with Mississippi State University and Alcorn State University in 1974, the SRDC is one of four regional centers whose mission is to support the rural development efforts of the Experiment Stations and the Extension Services in the 13 Southern states, Puerto Rico and the U.S. Virgin Islands. Current issues identified by the Center's program advisory committee through strategic planning are human capital development, leadership, rural health, and rural poverty.

A variety of means is used to address the issues once identified. They are as follows: seed-funded projects (multistate, multidisciplinary and/or regional in scope), conferences/seminars for professionals, publications, regional task forces of professionals addressing specific issues.

TAB B

Cooperative State Research, Education and Extension Service (CSREES)

Created by the Department Reorganization Act of 1994. The Cooperative State Research, Education, and Extension Service (CSREES) merged the former Cooperative State Research Service and the former Extension Service into a single agency with the mission to work with partners and customers to advance research, extension and higher education in the food and agricultural sciences and related environmental and human sciences to benefit people, communities, and the Nation.

Through a partnership with the system of State Agricultural Experiment Station (SUES), land-grant and other colleges and universities, and other public and private research and education organizations, and in concert with the Secretary of Agriculture and the intent of Congress, CSREES is USDA's principal link to the university system for the initiation and development of agricultural research and education programs. The USDA participates with State and other sources of funding to encourage and assist the State institutions in conducting agricultural research and education. CSREES also administers the National Research initiative. USDA's competitively awarded grants program targeted to fundamental and mission-linked research.

Additionally, CSREES as the Federal partner in the Cooperative Extension System, a nationwide educational network, is pledged to meeting the country's needs for research knowledge and educational programs that will enable people to make practical decisions. Its goal is to help people improve their lives through an educational process that uses scientific knowledge to focus on issues and needs. This public funded, nonformal, education network combines the expertise and resources of Federal, State, and local governments through the U.S. Department of Agriculture, 74 land-grant universities, and 3,150 county Extension units.

TAB C

The Federal Cooperative Extension System

The Cooperative Extension System is a nationwide educational network providing practical applications of state-of-the art research, science and technology to people where they live and work.

The System unites the talents and resources of government professionals at the federal, state, and local levels. This three-member partnership includes the Extension Service, U.S. Department of Agriculture; the 1862 and 1890 land-grant universities in the United States and its territories; and the 3,150 county offices.

Today's Cooperative Extension System focuses its educational resources on seven base programs and seven priority initiatives. The base programs are: Agricultural Competitiveness and Profitability; Community Resource and Economic Development; Family Development and Resource Management; 4-H and Youth Development; Leadership and Volunteer Development; Natural Resources and Environmental Management; and Nutrition, Diet and Health. Current initiatives are: Food Safety and Quality; International Marketing; Revitalizing Rural America; Sustainable Agriculture; Waste Management; Water Quality; and Youth at Risk. with the leadership of Extension experts throughout the country, the Cooperative Extension System provides vital information on these critical issues.

The Cooperative Extension System is charting a course for dynamic change in the century ahead: apply new advances in computers, videos, satellites, and other new technologies; and continuing to provide science-based educational information that Americans want and need.

TAB D

FEDERAL EXTENSION SERVICE
APPROPRIATIONS FOR 50 STATES AND 2 TERRITORIES
[IN THOUSANDS OF DOLLARS]

	FY95 APPROPS	FY96 PRESIDENT REQUEST	FY96 NASULGC RECOMMEND	FY96 HOUSE	FY96 SENATE	FY96 CONF
BASE PROGRAMS						
Smith-Lever 3b&c	\$272,582	\$272,582	\$283,485	\$264,405	\$272,582	\$268,493
D.C. Extension	0	0	0	0	0	0
1890 Colleges and Tuskegee	25,472	26,236	26,491	24,708	25,472	25,090
TOTAL BASE PROGRAMS EXTENSION	\$298,054	\$298,818	\$309,976	\$289,113	\$298,054	\$293,583
NATIONAL EXTENSION PRIORITIES	\$11,234					
Water Quality	2,475	\$11,234	\$11,234	\$10,897	\$11,234	\$11,065
Food Safety and Quality		2,475	2,475	2,400	2,475	2,438
Sustainable Agriculture	3,463					
Systems	10,000	4,963	4,963	3,463	3,463	3,411
Youth and Families at Risk		10,000	11,000	9,700	10,000	9,850
Sustainable Natural Resources	0					
Mgmt.		0	0	0	0	0
1890 Special Targeted Programs	0	0	0	0	0	0
Sustainable Agriculture/Small- Scale Farmers	0	0	2,000	0	0	0
Plight of Limited Resource Families	0	0	0	0	0	0
International Extension						
TOTAL NATIONAL EXTENSION PRIORITIES	\$27,172	\$28,672	\$31,672	\$26,460	\$27,172	\$26,764

	FY95 APPROPS	FY96 PRESIDENT REQUEST	FY96 NASULGC RECOMMEND	FY96 HOUSE	FY96 SENATE	FY96 CONF
SPECIFIED PROGRAMS						
EFNEP	\$61,431	\$61,431	\$61,431	\$59,588	\$61,431	\$60,510
Rural Development Centers/ Communities in Transition	950	950	3,000	921	950	936
Integrated Pest Mgt	10,947	15,000	15,000	10,947	10,947	10,783
Pesticide Applicator Training	0	2,000	2,000	0	0	0
Pesticide Impact Assessment	3,363	3,363	3,363	3,363	3,363	3,313
Farm Safety/AgrAbility	2,988	988	2,988	2,898	2,988	2,943
Reservation Extension Agents	1,750	1,750	3,000	1,697	1,750	1,724
1890 Extension and Research						
Facilities	7,901	15,000	10,000	7,664	7,901	7,782
Renewable Resources						
Extension Act*	3,341	3,341	6,000	3,241	3,341	3,291
Pacific Rim Program	0	0	0	0	0	0
Ag Telecommunications	1,221	1,221	1,221	1,184	1,221	1,203
Rural Health and Safety						
Education	2,750	2,750	2,750	0	2,750	2,709
Nutrition Education Initiative/ Healthy Babies	4,265	4,265	4,265	0	4,265	0
Rural Technology Grants	0	0	0	0	0	0
1862/1894 Inst. Comp. Coop Agreement	0	0	0	0	2,550	0
TOTAL SPECIFIED PROGRAMS	\$100,907	\$112,059	\$115,018	\$91,503	\$103,457	\$95,194
NEW PROGRAMS	Will require equal match from states and private sources					
Managing Change in Ag						
TOTAL NEW PROGRAMS						
FEDERAL ADMINISTRATION						
Direct						
Crop Simulation	\$12,611	\$5,102	\$5,102	\$6,181	\$10,998	\$12,209
	0	0	0	0	0	0
NET FEDERAL ADMINISTRATION	\$12,611	\$5,102	\$5,102	\$6,181	\$10,998	\$12,209
GRAND TOTAL EXTENSION	\$438,744	\$444,651	\$461,768	\$413,257	\$439,681	\$427,750

TAB E

FEDERAL EXTENSION SERVICE
REQUEST FOR 50 STATES AND 2 TERRITORIES
[IN THOUSANDS OF DOLLARS]

	FY95 APPROPS	FY96 PRESIDENT REQUEST	FY96 NASULGC RECOMMEND	FY96 HOUSE	FY96 SENATE	FY96 CONF	FY97 PRESIDENT REQUEST	FY97 NASULGC RECOMMEND
RASE PROGRAMS								
Smith-Lever D&C	\$272,582	\$272,582	\$283,485	\$264,405	\$272,582	\$268,493	\$0	\$280,018
1713 Extension	0	0	0	0	0	0	0	0
1890 Colleges and Inservice	25,472	26,216	26,491	24,708	25,472	25,090	0	26,168
TOTAL RASE PROGRAMS	\$298,054	\$298,818	\$309,976	\$289,113	\$298,054	\$293,583	\$0	\$306,206
NATIONAL EXTENSION PRIORITIES								
Water Quality	\$11,234	\$11,234	\$11,234	\$10,897	\$11,234	\$11,065	\$0	\$11,065
Food Safety and Quality	2,475	2,475	2,475	2,400	2,475	2,438	0	2,438
Sustainable Agriculture								
Systems	3,463	4,963	4,963	3,463	3,463	3,411	0	4,411
Youth and Families at Risk	10,000	10,000	11,000	9,700	10,000	9,850	0	10,850
Sustainable Natural Resources								
Management	0	0	0	0	0	0	0	0
1890 Special Targeted Programs								
Sustainable Agriculture Small- Scale Farmers	0	0	0	0	0	0	0	0
Producers of Limited Resource	0	0	2,000	0	0	0	0	0
Producers	0	0	0	0	0	0	0	0
International Extension	0	0	0	0	0	0	0	0
TOTAL NATIONAL EXTENSION PRIORITIES	\$27,172	\$28,672	\$31,672	\$26,460	\$27,172	\$26,764	\$0	\$28,764

	FY95 APPROPS	FY96 PRESIDENT REQUEST	FY96 NASULGC RECOMMEND	FY96 HOUSE	FY96 SENATE	FY96 CONF	FY97 PRESIDENT REQUEST	FY97 NASULGC RECOMMEND
SPECIALIZED PROGRAMS								
FFAP	\$61,431	\$61,431	\$61,431	\$59,588	\$61,431	\$60,510	\$0	\$61,510
Rural Development Centers	950	950	1,000	921	940	916	0	916
Integrated Pest Mgt	10,917	15,000	15,000	10,947	10,947	10,783	0	15,000
Pesticide Applicator Training	0	2,000	2,000	0	0	0	0	0
Pesticide Impact Assessment	3,363	3,363	3,363	3,363	3,363	3,313	0	0
Farm Safety, Acc. Abil.	2,000	0	2,000	2,000	2,000	2,000	0	2,000
Recreation Extension Agents	1,750	1,750	1,000	1,697	1,750	1,724	0	1,724
1890 Extension and Research Facilities	7,901	15,000	10,000	7,664	7,901	7,782	0	7,782
Renewable Resources								
Extension Act*	3,341	3,341	6,000	1,211	3,341	3,291	0	3,412
Ecologic Risk Program	0	0	0	0	0	0	0	0
Ag. Telecommunications	1,221	1,221	1,221	1,184	1,221	1,203	0	1,203
Rural Health and Safety								
Education	2,750	2,750	2,750	0	2,750	2,700	0	2,700
Nutrition Education Initiative								
Diets for Babies	4,265	4,265	4,265	0	4,265	0	0	0
Rural Technology Grants	0	0	0	0	0	0	0	0
1987-1991 Inst. Comp. Coop. Agreement	0	0	0	0	2,500	0	0	2,500
TOTAL SPECIALIZED PROGRAMS	\$100,907	\$112,000	\$115,018	\$91,503	\$103,457	\$95,194	\$0	\$99,835
NEW PROGRAMS								
Matching Change in Ag.	Will require equal match from states and private sources							\$5,000
TOTAL NEW PROGRAMS								\$5,000
FEDERAL ADMINISTRATION								
Direct	\$12,611	\$5,102	\$5,102	\$6,181	\$10,998	\$12,200	\$0	\$5,102
Coop. Simulation	0	0	0	0	0	0	0	0
NET FEDERAL ADMINISTRATION	\$12,611	\$5,102	\$5,102	\$6,181	\$10,998	\$12,200	\$0	\$5,102
GRAND TOTAL EXTENSION	\$438,744	\$444,651	\$461,768	\$413,257	\$439,681	\$427,750	\$0	\$444,907

TAB F

The Mississippi Cooperative Extension Service Who We Are

Our Mission

The Mississippi Cooperative Extension Service provides research-based information, educational programs, and technology transfer focused on issues and needs of the people of Mississippi, enabling them to make informed decisions about their economic, social, and cultural well-being.

Our Foundation

The Smith-Lever Act of 1914 established the Cooperative Extension System, a publicly funded, informal educational system that links the United States Department of Agriculture, the land-grant university system, and individual counties. As the off-campus educational arm of Mississippi State University, Extension provides current research and educational information to individuals in all 82 counties. Mississippi Cooperative Extension Service is also a cooperating partner with Alcorn State University, the 1890 land-grant institution in Mississippi. Agriculture and natural resources, family and consumer education, enterprise and community resource development, and 4-H youth development are Extension's ongoing priorities or "base programs." From these base programs, specific subjects or efforts emerge to receive emphasis for a period of time.

Our Vision and Beliefs

Extension's overall purpose is education - education that will empower people to make intelligent decisions relating to their vocations, their families, and their environment. Extension's unique interdisciplinary perspective enables the organization to make a real difference in the lives of Mississippians. Mississippi Cooperative Extension Service is, and will continue to be, a leader for positive change for individuals, families, and communities through the following ways: by providing research and education in a practical and applicable way; by using the latest technology and teaching techniques to serve clients; by developing and using volunteers to help disseminate programs and information; by cooperating with other groups and agencies; and by maintaining a culturally diverse staff responsive to the needs of various audiences at all socioeconomic levels.

We believe that agriculture and its related enterprises are of major economic importance in Mississippi, and we will direct programs and resources to reflect this importance. We also believe that quality of life is affected by the reciprocal relationship between people and their environment and will continue to emphasize environmental issues. We recognize the critical need for human resource development and will continue to search for ways to help families and youth cope with an ever-changing society.

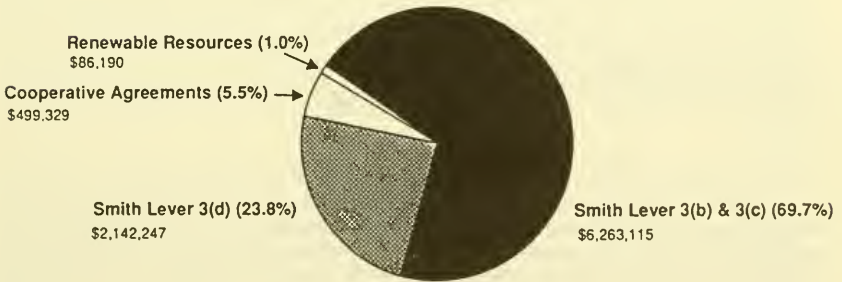
Our Goals

To fulfill our mission and to achieve our vision for the future, Mississippi Cooperative Extension Service must meet the following goals:

- Focus on quality services and programs that are client-driven
- Focus on quality services and programs that are client-driven
- Instill a future-oriented perspective in staff members, advisors, partners, and clients.
- Be responsive to new or different needs by maintaining flexibility in programming efforts.
- Develop a level of alternative resources to allow for adjustments to changing demands or critical needs.
- Expand efforts to help clients compete in a global economy.
- Foster an environment that will enable staff members and volunteers achieve their full potential.
- Project a positive image that will broaden public understanding of Extension's mission, goals, programs, and accomplishments.

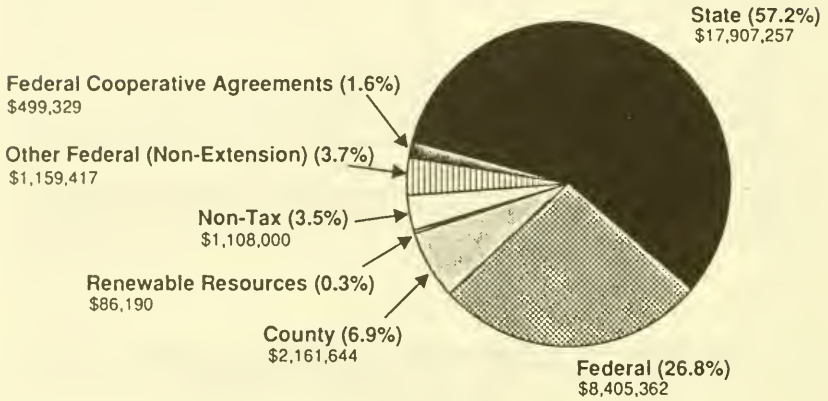
TAB G

Mississippi Cooperative Extension Service Federal Budget by Source of Funds FY 1995-96



TAB H

Mississippi Cooperative Extension Service Overall Budget by Source of Funds FY 1995-96



TAB I

Federal Base Program Funding FY '96 Mississippi Cooperative Extension Service

\$5,807,821

Base programs are the major educational efforts central to the mission of Extension and common to counties. The base programs are the ongoing priority program efforts of Extension, involving many discipline-based and multidisciplinary programs. They can be thought of as the foundation of a building, while the priority initiatives rise from the base to receive special emphasis for a period of time. Following are the educational base programs of Extension:

- Agriculture and Natural Resources
- Family and Consumer Education
- Enterprise and Community Resource Development
- 4-H Youth Development

Agriculture and Natural Resources

Mississippi Cooperative Extension programs in Agriculture and Natural Resources touch all Mississippians, from home gardeners to the state's largest farmers, food processors, and agribusinesses. Programs focus on the economy, the environment, and family/youth development. As Mississippi State University's "classroom in the field", our practical programs are based on needs identified in local communities. This information highlights the diversity of our programs throughout the state.

Agricultural Economic Growth and Development

Beef Cattle Extension developed the Farm to Feedlot project to give beef cattle producers information about their calves beyond the weaning phase. The program identifies management practices and breeding

programs that yield the best product and the highest profit. Objectives are to help producers understand retained ownership as a marketing alternative, evaluate carcass information in their breeding programs, and evaluate pre- and post-weaning health programs. In 1995, cattle producers shipped 495 steers from 26 counties to a Kansas feedlot and received performance and carcass data for all animals. More than 34 percent of the steers made a profit of \$75 or more over what they would have been worth at the time they were shipped. Extension continued the Maximum Immunity-Minimum Stress (MIMS) beef cattle health and management program. About 6,000 calves were certified into this program, and 5 calf sales were held to market these preferred calves. Results showed an increase of 23 pounds of gain per calf. Ninety percent of MIMS beef producers obtained \$25 to \$30 additional profit per calf.

Cotton. Cotton demonstrations and a cotton production short course showed growers new management approaches to production. Three of the demonstrations tested transgenic cotton varieties (an emerging technology in cotton production). Thirty cotton demonstrations were conducted to show advantages of plant growth regulators, early maturing varieties, proper nitrogen and potassium fertilizer, management for earliness, and improved harvesting techniques. A newsletter reached 4,000 growers with the latest production and marketing information.

Vegetables. In 1995, commercial vegetables were produced on 40,000 acres in 79 of Mississippi's 82 counties. Vegetable production and marketing programs yielded significant benefits to Mississippi producers. Growers in south Mississippi increased their use of plastic mulch, and a large contract for processing squash increased the squash acreage to record levels. Yellow squash, okra, broccoli, and bell pepper crops made an average profit of \$7,439 for growers in selected counties. The greenhouse tomato industry continues to grow in Mississippi. In the past 6 years, the number of Mississippi growers increased from 15 to 110, comprising 15 acres under plastic. Gross sales are now in excess of \$3 million, placing Mississippi in the top 10 states in the U. S. in greenhouse tomato production.

Soybeans. Extension continued its leadership in soybean production and marketing education with its SMART Program (Soybean Management by Application of Research and Technology). This program, which is in its fourth year, emphasizes the use of currently available production monitoring, management, and technology. Soybean producers made significant changes in variety selections to increase yield and improve maturity. In 1995, 35 percent of Mississippi's acres were planted to earlier maturing, indeterminant varieties. This represents a 10 percent increase over 1994. In addition, a third annual regional soybean conference provided production requirements and variety information for all 82 Mississippi counties.

Aquaculture. In support of the aquaculture industry, 12 workshops and seminars were presented on catfish hatchery management, catfish health management, water quality analysis, and management in culture systems for catfish and other species. Educational programs resulted in an increase of 1,500 water acres of catfish production in east Mississippi, an area not traditionally associated with catfish production but now comprising 5,000 acres. In addition, Extension continued assistance to the catfish industry and Catfish Farmers of America in implementing its Quality Assurance Program. Introductory workshop and field days were conducted for existing and prospective tilapia producers and for producers of freshwater prawns. A prawn production demonstration was conducted and three new publications were developed to help explore freshwater prawn as a possible aquaculture enterprise.

Soil Testing. Extension's Soil Testing Laboratory continues to make a positive impact on farmers production practices. The laboratory analyzed over 28,000 soil samples, and almost 2,000 plant tissue samples were analyzed for multiple elements. Results of testing programs show that farmers with high cash crops are making significant and continued improvement in fertility levels of their soils.

Forages. Extension professionals from veterinary medicine, animal science, agricultural economics, and agronomy are currently working with 43 Integrated Resource Management (IRM) beef demonstration farms in all areas of beef production. Publications on cool season legumes, alfalfa, bahiagrass, quality grazing, and bermudagrass have been revised and updated. Educational programs in forage production have resulted in 33 forage production meetings, 9 radio programs, 11 monthly newsletters and 10 "Cattle Business Magazine" articles. A wall chart was prepared for forage seed suppliers showing forage types, varieties, planting dates, and rates.

Blueberries. Improved efficiency, favorable weather, and new technology contributed to a record-breaking blueberry harvest for Mississippi producers this year. More than 2 million pounds of blueberries were harvested in 1995 from about 1,500 acres. About half of the berries were marketed as fresh, and the other half were marketed as frozen. Prices for fresh berries have remained steady for the past 8 years with an

average of \$12 per flat being received. Total farm gate value for blueberries for 1995 is reported at about \$1.27 million with overall impact valued at \$3.12 million.

Natural Resources and Environmental Management

Pesticide Application and Recordkeeping. Extension Pesticide Recordkeeping program was developed to document the proper use and inventory of agricultural pesticides. The Delta Exposition provided an opportunity for 3,000 persons to learn about the records program, and a slide set and video program were also developed and distributed to all 82 counties. Extension also developed enterprise budget information on the costs of pesticides to help farmers compare costs and plan their commodity production programs using crop-planning budgets. Extension Pesticide Applicator Training program reached 23,000 individuals and had the following results: improved handling procedures, improved pesticide storage, and reduced chemical carryover. Additionally, 4,904 individual contacts were made through the Pesticide Impact Assessment Program, providing information on the safe use of agricultural pesticides on Mississippi crops.

Forestry. Extension provided intensive Forest Management Short Courses to 421 landowners. An additional 2,000 landowners were reached through meetings, field days, demonstrations, and tours. Natural Resource Manager Short Courses reached 1,325 individuals and covered the following topics: best management practices, forest stewardship, environmental issues, hardwood management, and prescribed burning. Overall, Extension programs made an impact on more than 725,000 acres of forestland. The value of information received by landowners was estimated to be in excess of \$4.3 million.

Reduced Chemical Use. Integrated Pest Management (IPM) practices are being used in a number of crop production systems in Mississippi. Extension has had a major role in incorporating IPM practices into the commercial production of cotton, soybeans, rice, corn, wheat, and greenhouse tomatoes. IPM practices have resulted in significant reduction of agricultural chemical use. Extension plant pathologists and horticulture specialists conducted a series of inservice training activities for 17 Alcorn State Extension program agents and technicians. This joint effort provided training for agents as they developed disease and nematode management programs for low-income producers in the southern part of the state. Crops covered included crucifers, cucurbids, tomatoes, peppers, potatoes, other vegetables, and fruit crops as well as training in disease diagnosis.

Improving Health, Productivity, and Family Well-Being

Agricultural Safety. Educational programs ranged from new developments in the Worker Protection Standard (WPS) Program to industrial safety information included in a Cotton Ginners Short Course. The agricultural safety program reached 2,511 Mississippians with farm and agribusinesses safety information. This program also effectively used volunteers to deliver information.

4-H Youth Development

As pressures on young people escalate, the entire community must become involved in providing them positive experiences. 4-H Youth Development provides preventive education that focuses on life-long skills. Through 4-H, young people learn to interact positively with peers, family members, and others around them. They can be productive citizens by contributing to group goals and by developing job skills and positive work ethics. Youth are on the way to becoming valuable members of society when they experience the importance of community service and volunteerism. 4-H continues to invest in the future of our Mississippi youth.

More than 39 percent of all 4-H'ers live in towns with populations greater than 10,000. These members participate in the same types of projects as do the 9 percent who live on farms and the 52 percent who live in towns with less than 10,000 residents.

4-H programs are offered in all 82 counties. Youth participate either as individuals or through community clubs, school enrichment programs, special interest groups, and after-school child care. Of the total number of Mississippi youth in 4-H, 51.8 percent are from minority racial-ethnic groups.

Development of Productive and Self-Motivated Adults and Youth

Individual and family resource projects involved more than 19,552 youth discovering home and personal management, family life and child-care education, and consumer and clothing education.

Volunteers are essential to the successful delivery of 4-H programs. In 1995 there were 3,222 volunteer leaders who worked directly and indirectly with youth. The average 4-H volunteer leader donates 220 hours per year in 4-H activities; thus, for each hour salaried staff members spend in 4-H, a volunteer spends 12 hours. Each volunteer drives an average of 300 to 400 miles for 4-H in a personally owned vehicle and spends \$40 to \$60 annually on teaching materials. The estimated value of the total time volunteers devote to 4-H, plus their out-of-pocket expenses is about \$5,400,000.

State 4-H Junior and Senior Leadership Conferences involved more than 200 youth. Workshops focusing on communication, team building, self-awareness, resources and decision making were taught by State 4-H Awareness Teens.

Washington Focus, held at the National 4-H Center, allows young people to study national government, visit their congressmen, and see history come to life as they tour our nation's capital.

Four Senior 4-H members and one volunteer leader represent Mississippi's investment in youth during the annual National 4-H Conference held at the National 4-H Center. The Conference provides input into planning in the Extension System for 4-H Youth Development Education Programs.

Natural Resources and Environmental Management

Natural resource projects continue to be the most popular in Mississippi, involving more than 43,758 youth. These projects teach ecology, geology, entomology, conservation of natural resources, soils, forestry, wildlife education, and shooting sports.

Twenty-one Mississippi 4-H'ers served as teen leaders at the annual Northeast Resource Conference held at Crow's Neck Environmental Education Center. These teen leaders assisted with workshops focusing on the knowledge and skills they had attained about natural resources while representing Mississippi at the Regional Resource Conference in Fontana, North Carolina.

More than 10,000 youth throughout the state learned ways to preserve Mississippi's water quality and quantity through demonstrations, workshops, and camps this past year.

Community Pride continues to play a major role in the 4-H environmental stewardship project. This year, Chevron USA has more than doubled its contribution to encourage expansion of the audience reached through Extension's efforts. Grants and awards in the amount of \$30,000 were awarded to 84 different groups. Each Chevron grant dollar generates more than seven dollars in local support, including involvement from local Chevron employees. Examples of outstanding projects seeded with Chevron grants include the following:

Backwoods Gang 4-H Club restored a historical cemetery from the 1800's located in deep woods, while preserving a 200 year-old red oak in Pearl River County.

"Cleaner Air for Clearer Minds" was the campaign led by Webster County 4-H'ers who promoted awareness of indoor air pollution.

More than 800 Lowndes County youth had fun while learning about water quality, hunter education, conservation practices, and nature trails during the Conservation Field Days and Earth Days. These various workshops were conducted through the coordination of 72 volunteers representing 23 different organizations.

Improving Health, Productivity, and Family Well-Being

A total of 109,199 Mississippi youth were enrolled in 4-H youth development educational programs this year. They were involved in hands-on learning experiences in more than 100 subjects that also helped

them develop important decision-making, communications, and leadership skills while developing positive self-esteem.

4-H professionals cooperated with kindergarten through high school teachers to deliver hands-on classroom programs in science, literacy, and personal development. These 4-H School Enrichment programs reached more than 76,900 students.

Safety skills are incorporated into every 4-H project. Bicycle safety practices will establish similar safety habits when young people begin driving automobiles. Coahoma, DeSoto, Grenada, Panola, Quitman, Tallahatchie, Tate, Tunica and Yalobusha Counties combined efforts with the Health Department and local law enforcement to implement a multi-county bicycle safety awareness program that reached more than 5,000 first and second graders.

Five hundred youth learned how to identify poisonous and nonpoisonous snakes, insects, and plants in Marshall County's Alert ! Poisonings program held during the National Youth Sports Program in Holly Springs.

Enterprise and Community Resource Development

The Enterprise and Community Resource Development Program Area is designed to bring the resources and expertise of four units (Community Development, Energy Extension Center, Extension Geographic Information Systems Unit, and Food and Fiber Center) into a cohesive effort to assist the people of Mississippi in developing and expanding communities, agribusinesses, the economy, governmental effectiveness, and environmental awareness.

Agricultural Economic Growth and Development

Interest continues to be strong in county multipurpose facilities. Extension Community Development helped supervisors in five counties conduct economic impact studies of such facilities. The supervisors included the studies in proposals submitted for funding.

The 1995 Catfish Processing and Feed Conference, cosponsored by Extension Food and Fiber and The Catfish Journal, official publication of the Catfish Farmers of America, was held in Jackson with approximately 100 people attending. Program topics covered processing techniques, methods of compliance, regulations, and research.

Extension coordinated efforts to secure funding for a blueberry shed in south Mississippi. Preliminary estimates indicated that the grant monies were sufficient for this facility to serve both as a local fresh and wet blueberry processing operation and as a central distribution point. Extension Food and Fiber personnel worked with the county supervisors to prepare building layouts and equipment specifications. The building was constructed and handled about 210,000 pounds of wet and dry berries in its first year of operation.

Management, marketing, and financial assistance were provided to a vegetable packing shed in south Mississippi for the past 5 years. Sales in 1994 were in excess of \$360,000 with returns to the farmers in excess of \$250,000 or 69 percent of sales. This shed has increased operation from 6 weeks in 1991 for one crop to 8 months in 1995, handling 20 crops. This vegetable cooperative is a good example of teamwork, cooperation, and dedication of farmers, local officials, legislators, the Mississippi Department of Agriculture, county Extension staff, and the Extension Food and Fiber Center.

In a cooperative effort with Virginia Tech, Louisiana State University, the University of Florida, and the Extension Food and Fiber Center, a comprehensive educational program was developed that enables aquaculture firms to use Total Quality Assurance (TQA) and Hazard Analysis Critical Control Point (HACCP) concepts for the processing of safe and wholesome processed aquacultural products. An instructional manual was completed, and 100 have been distributed to catfish processors and others in the catfish industry.

A study was conducted and findings released in a report entitled "Modern Timber Bridges in Mississippi: An Examination of Critical Issues." The study addressed the development of a modern timber bridge manufacturing industry in Mississippi and was a joint effort between Extension Food and Fiber and other Mississippi State University departments. A teleconference, downlinked to eight Mississippi sites along

with sites in six other states, was also used to disseminate study results. The study provided local and state decision makers pertinent information for infrastructure development.

Mississippi currently ranks fifth among broiler-producing states. Several large integrators are expanding and are seeking broiler producers, particularly in the southern part of the state. Food and Fiber Center staff are working with economic developers, state agencies, and individuals to explore opportunities for the development of new processing facilities and accompanying production units. One such meeting in 1995 involved over 40 key community leaders from a 6-county area. Speakers included representatives from Mississippi State University, Mississippi Agribusiness Council, Mississippi Department of Economic and Community Development, and Mississippi Cooperative Extension Service. As a result of this meeting, a recruitment package will be developed to attract an integrated poultry complex to the area.

Industrial development often means survival for a community. Geographic-based information is necessary for businesses or state agencies to make informed decisions about the location or expansion of new industries. In response to this need, Extension's Geographic Information Systems Unit (GIS) has provided the following information: 1) senior citizen population data to a health-care organization seeking a location for a retirement center; 2) land transportation network data overlaid on empowerment zone maps; 3) soybean production data within various radii of proposed processing facility; and 4) data mapping showing migration of the wood furniture industry.

Extension Community Development and the Mississippi Department of Economic and Community Development produced a tourism video that is used to provide training and guidance for communities interested in promoting rural tourism.

Natural Resources and Environmental Management

Through the Mississippi Waste Pesticide Disposal Program conducted through the Extension Energy Center, more than 280,000 pounds of waste agricultural pesticides have been disposed of through a licensed hazardous waste contractor. Before the 3-year program is completed, several hundred thousand pounds of waste pesticides will be properly disposed of and will no longer be a threat to the environment. As an added service, the program also has disposed of more than 8,200 gallons of used oil and more than 600 worn-out batteries from farm vehicles.

The Mississippi Pesticide Container Recycling Program, also begun by the Extension Energy Center in 1989, continues to be a national leader in recycling pesticide containers. Since the program started, more than 2.5 million pounds of pesticide containers have been recycled. The benefits of the program are an improved environment, reduced demand for landfill space, and cost savings to farmers through efficient pesticide use.

The Energy Center's aquifer model, or water quality model, teaches citizens how to protect groundwater and surface water from contamination. In 1995, this educational program was demonstrated to over 15,000 young people through 4-H and school environmental activities. Through Extension's Farm-A-Syst program, more than 3,000 farmers and other rural residents received information about management practices that affect water quality. Farm-A-Syst helps farmers identify activities or conditions that may be a risk to water quality.

Development of Productive and Self-Motivated Adults and Youth

Community Development specialists serve on the design team of a Kellogg Leadership Program known as PRO-MISS. The specialists teach and provide expertise in government, community, and economic development. More than 100 citizens and leaders from across the state have benefitted from this program.

Training was provided by Community Development specialists to the mayor and council of a major Mississippi city on their respective roles and responsibilities.

Community Development provided special training programs for newly elected county government officials on their new duties and responsibilities before they take office; follow-up training is offered after they take office. Officials who benefit from this training include county supervisors, tax assessors and collectors, and chancery clerks. County Government in Mississippi: A Handbook for County Supervisors was published for this training.

The Extension GIS Unit provided technical assistance, demonstrations, and training to multiple entities involved in county and city governments, as well as private organizations. An annual workshop and quarterly meetings were held to help users of these systems provide the decision makers in their area with complete and accurate data.

Improving Health, Productivity, and Family Well-Being

Community Development specialists from Mississippi State and Oklahoma State Universities met in Jackson to discuss the economics of rural health in the South. This meeting preceded a one-day conference on rural health in Mississippi. More than 275 people attended the one-day event.

Community Development helped three counties develop an assessment study of child-care needs. Also, a study of industry perspectives of employee child-care needs was conducted.

Extension Community Development worked with the Mississippi Rural Water Association in developing a video entitled "Duties and Responsibilities of Board Members." This video is being used in training rural water board members throughout the state.

Locating dry fire hydrants is a critical step in development of a rural community's fire protection system. Extension GIS is working with state agencies and the U.S. Forest Service to provide accurate mapping of all Mississippi counties, detailing county fire districts, lakes, and access roads. These maps enable county planners to supply fire protection to their citizens in an effective and cost-efficient manner by determining the best locations for the dry hydrants.

The Extension GIS Unit provides maps to city and county planners detailing transportation, hydrography, and energy infrastructure (including location of oil and gas pipelines) of their areas for use in development of Emergency Management Systems. Similar assistance is provided by mapping county water systems and mapping/inventory of public utilities for supervisors and other county or city decision makers who must determine funding priorities in their areas.

Census data have been converted by Extension GIS into a series of 35 maps which outline housing, income, race, and employment statistics. Decisions regarding programming efforts for several state agencies will be enhanced by the availability of census data presented in a clearly detailed map.

Family and Consumer Education

More than 772,800 Mississippians are reached each year through Extension's Family & Consumer Education Program. Eighty-four county, area, and state home economists provide leadership for programs that focus on family development, nutrition and health, economic security, and consumer education. Programs are based on needs of local citizens and communities, new research, and technical information. This brochure highlights the diversity of the Family & Consumer Education program throughout the state.

Development of Productive and Self-Motivated Adults and Youth

More than 2,500 child-care providers received educational training and materials focusing on topics such as guidance, self-esteem, single-parent families, and parent involvement.

In cooperation with the Department of Human Services and the Welfare Department, Extension personnel taught parenting education classes to more than 200 abusive parents and to parents of children in the juvenile court system.

In Adams County, Extension and Catholic Charities worked together to obtain a \$30,000 grant from the Children's Trust Fund in Mississippi to fund a child abuse and neglect project.

Staff development training was conducted for nurses from the Alcorn State University Nursing Clinic, resulting in improved interaction about sexual issues between the nursing staff and patients.

Three parenting workshops were taught at Keesler Air Force Base at the request of their Base Family Advocacy Office.

At the Golden Triangle Area Agency on Aging spring picnic, health screenings were provided for 179 senior citizens who attended. Tests showed that 13 participants had high blood glucose readings, and 6 of these were found to have undiagnosed diabetes. Three persons had extremely high cholesterol readings; 51 had high blood pressure readings; and 16 had vision problems.

One thousand five hundred Head Start teachers participated in educational training conducted by Extension, reaching more than five thousand families.

In Clarke County, educational programs about Hospice care inspired homemakers to become Hospice volunteers, providing care for terminally ill patients.

Special education students in Amite and Franklin counties benefitted from programs on dining etiquette provided through a cooperative effort of Extension agents from Alcorn and Mississippi State University.

4-H clothing projects enrolled a total of 1,569 young people. Basic sewing classes are offered as well as the relationship of clothing to self-esteem and image.

Intensive parenting education programs were provided to 100 teen parents. Participants reported a greater understanding of parental responsibilities, improved skills, and better self-esteem.

The Children's Defense Fund collaborated with more than 20 home economists for regional parenting education conferences held throughout the state. Programs focused on responsibility training and discipline techniques.

More than 100 programs on food handling, safety, and sanitation were presented. About 28,500 individuals were reached through leader training, demonstrations, workshops, group meetings, exhibits, and short courses.

A total of 4,456 nutrition education programs, individual consultations, and media activities were conducted, reaching 101,647 people.

Through a series of lessons called "Babytalk, pregnant and parenting teens in Bolivar, Coahoma, and Tunica Counties learned about nutrition and health through special school classes and social service programs.

Three health agents provided instruction in sexual responsibility, prevention of sexually transmitted diseases, and good decision making to 3,450 high school and middle school youth. Publications on these topics were developed and distributed to more than 9,350 people.

Natural Resources and Environmental Management

In Lowndes County, the Weyerhaeuser Company Foundation provided \$10,000 in grant funds, and the Extension Service provided educational materials through the "Away with Waste" program. Extension personnel provided hands-on training in the 19 schools participating in the program, reaching about 2,000 students. Students learned about recycling, habitat management, community pride, positive thinking, and more.

A recycling program is saving money for Franklin County while reducing the amount of waste going into landfills. In a cooperative effort with school officials and the U.S. Forest Service, Extension personnel conducted educational meetings and produced newsletters and a publication. As a result, three trailers were designated for collection and transport of recyclable material to a recycling center in Natchez, saving Franklin County about \$150 a month in waste disposal costs.

Economic Growth and Development

Fifty-seven senior citizens attended a series of workshops that addressed the problems of fraud, scams, and other ripoffs.

A 6-lesson series, "Caregivers as a Business" was jointly sponsored by Extension and the Delta Community College Small Business and Development Center. Classes focused on the basic aspects of operating a child-care center, from writing a business plan to maintaining a learning environment for children. An average of 18 people attended each session.

A new home-buyer education program has been implemented in three counties, funded through FHA. It is designed to teach low- and moderate-income families the process of home purchasing, such as taxes, insurance, and maintenance.

About 150 counselors on the Gulf Coast military base were trained in how to help employees deal with financial matters of credit and contracts.

Development of Productive and Self-Motivated Adults and Youth

Members of the Mississippi Homemaker Volunteers, Inc. provided more than \$4 million in volunteer service hours. These hours included educational programs, community projects, University Children's Hospital Project, and local public policy involvement. Three thousand therapy dolls were made and donated to University Children's Hospital to help children cope with their illnesses.

Firefighters in Perry, George, and Stone Counties were trained in how to provide programs for children in elementary schools, day care centers, and Head Start. These firefighters reach about 500 children each year.

Through Mississippi Homemaker Volunteers, more than 5,400 women learned about children and television, public policy education, seatbelt safety, health screenings, health and nutrition, and financial management.

TAB J

Federal National Priority and Specified Programs Funding FY '96 Mississippi Cooperative Extension Service

\$2,891,942

Smith-Lever 3(d) funds appropriated restricted dollars, represent critical programs such as Integrated Pest management, Sustainable Agriculture, Renewable Resources, EFNEP, and Youth at Risk programs. These programs represent national interest and Extension in Mississippi has made wise use of these dollars in addressing critical statewide issues.

Title: Water Quality

**Funding
Amount:** \$53,500

Description: This program is designed to inform the public about the importance of preserving quality in both drinking water and surface waters of Mississippi. A major emphasis of the program is to preserve drinking water quality in rural areas by targeting farmers and other rural homeowners who continue to use private wells as a drinking water source. Mississippi has about 48,000 of these wells.

Although tests indicate water quality is good in most private wells, it is important that farmers and rural homeowners use practices recommended in this program to protect water supplies from possible contamination. The program is conducted through meetings, demonstrations, and visits, and includes publications, exhibits, and other educational information developed for the targeted audience.

An additional thrust of this program is conducting educational aspects of the Mississippi Waste Pesticide Disposal Program, which helps farmers dispose of waste or leftover agricultural pesticides. These educational aspects are designed to encourage farmers to participate in local waste pesticide disposal programs.

Impact: Through this program, an estimated 800 farmers and more than 10,000 young people have received information about the importance of protecting water resources in Mississippi.

More than 1,200 water quality tests have been performed for farmers and rural homeowners as part of Extension's overall water quality programs. Publications have been developed on the importance of sealing abandoned wells, potentially a major source of drinking water contamination, and on how to disinfect a contaminated well.

As a result of the Mississippi Waste Pesticide Disposal Program, more than 280,000 pounds of waste agricultural pesticides have been safely disposed of. The benefits of this program are reduced health risks, reduced water quality and environmental risks, and an improved rural environment.

A working aquifer model which shows underground water movement and how it may become contaminated is used extensively in educational demonstrations, along with water quality exhibits and other supporting information. Additional educational materials have been developed for use by county Extension staff who work directly with individuals who have water quality problems.

As a result of this and other related work, more and more Mississippians understand the importance of preserving their water resources, for their own benefit and the benefit of others who share this important natural resource.

Title: Food Safety and Quality

Funding Amount: \$25,000

Description: The Mississippi Cooperative Extension Service through the Food Safety and Nutrition Education Training for Child Caregivers program is providing the vital educational link needed to educate caregivers in this state about critical food safety and nutrition issues related to the safety and well being of our children. The purpose of this program is to insure that Mississippi's children receive safe and nutritious foods and to reduce the incidence of foodborne illness by educating child care facility personnel about proper food safety, sanitation and nutrition to insure that our children are served safe, high quality and nutritious foods.

The Mississippi State Department of Health's (MSDH) Division of Sanitation has indicated that food safety training for food service employees is not only needed in Mississippi but must be a priority for our state but that the MSDH does not have the resources necessary to devote to grassroots training. Due to the cooperative efforts of the Cooperative Extension Service, the Mississippi State Department of Health's (MSDH) Division of Sanitation and the Mississippi Restaurant Association (MRA), high quality and intensive food safety training has become a reality for the over 16,000 commercial food service establishments through the Food Safety Training for Restaurant Personnel. This program provides intensive food safety training at the county level which addressed critical issues such as microbiological hazards, importance of proper personal hygiene, cross contamination, time and temperature abuse, safe preparing and serving of food, hazard analysis critical control points and cleaning and sanitizing.

Impact: Through county based programs Extension home economists have disseminated information through approximately 359 group meetings, 19 field days/shows, 29 exhibits/displays, 92 newsletters, 10 satellite/short courses and 25 consultations reaching an estimated 26,692 individuals. Additional people were reached through over 405 mass media efforts which include radio, television and newsletter releases. Approximately 10, 942 individuals received food safety information as a result of personal letters, phone conversations, home/farm visits and office visits.

In 1995, sixteen agents offered the Food Safety and Nutrition Education for Child Caregivers Training throughout the state reaching an estimated 527 caregivers with food safety information, 574 with nutrition information and representing over 138 licensed child care centers. Conservative projections, based on the child teacher ratio, this training has a positive effect on the care of over 12,500 children in Mississippi. Child caregivers employed by licensed child care facilities are required by law to complete 15 hours of

continuing education annually and can only receive credit for a completion of a course one time. Thus combined with the 1994 efforts where over 1197 individuals, representing 226 centers completed the food safety training and over 1209 individuals, representing 221 centers, completed the nutrition training, over 28,000 children are being cared for in safer environments and receiving safer and more nutritious foods.

In the initial year of the Food Safety Training for Restaurant Personnel, the six hours of intensive food safety training was offered over 18 times throughout the state, reaching over 424 commercial food service employees. A 37% increase in knowledge obtained through a pre- to post- test knowledge survey, indicated that participants are completing the sessions with a much stronger understanding of the food safety arena. Primary recipients of the training have included employees of commercial restaurants, hospital food service, school food service, head start, and nursing homes. The MSDH has essentially considered the Extension Service as the major provider of food safety education for these groups, as well as others, and refers all requests for training to the county home economists. As this program continues to grow, the impact of its efforts will be felt statewide through a safer food supply.

Title: Sustainable Agriculture Systems

Funding Amount: \$20,000

Description: The Sustainable Agriculture System program is a joint effort between the Cooperative Extension Service at Mississippi State University and the Alcorn Cooperative Extension Program at Alcorn State University. The overall objective of this program is to develop a Sustainable Agriculture Strategic Plan for Mississippi. Several issues to be addressed as part of the program are as follows:

- Clearly define sustainable agricultural concepts and how they may be adopted by Mississippi producers.
- Identify sustainable agricultural interest groups in the state and groups that need sustainable agricultural training.
- Conduct intensive training in sustainable agricultural concepts for county Extension workers.
- Develop educational materials that can be used to present sustainable agricultural concepts.
- Create a medium for dispensing sustainable agricultural information.

Impact: Extension and the Mississippi Agricultural and Forestry Experiment Station will develop a survey of existing sustainable agriculture practices statewide to serve as base line data to measure the impact of future sustainable agriculture programs. Sustainable Agricultural Extension programs support seven agricultural commodity areas that rank in the top ten nationally.

Title: Youth and Families at Risk

Funding Amount: \$420,141

Description: Grants averaging less than \$100,000 nationally are provided to support Youth at Risk activities on a 5-year cycle, with Federal funds gradually phasing out over that time period. In the sixth year the program is expected to be self-sustaining. In Mississippi, there are three outstanding programs in varying stages of development.

Impact: One, the After School Child Care Education program is a collaborative effort of the Mississippi Cooperative Extension Service and Alcorn Extension Program and local school districts which targets children grades K-4 in the two rural Mississippi communities of

Fayette and Greenville. The program is in its fifth year of funding and will become self-supporting next year. Children performing below their potential are identified by teachers, school administrators, or primary care givers to participate in the program after school hours. The program's purpose is to improve academic performance, build self-confidence and prepare students to become more productive in later life. Children are divided into small groups where they receive a nutritious snack, help with homework, and tutoring. Parents are also involved through activities to help improve their parenting skills, support, and encourage their children's educational progress, and increase their own educational attainment.

Classroom teachers report that children in the Extension Service After School Program come to school with a much greater understanding of why they are in school and bring in completed homework assignments much more frequently. School principals report less disruptive behavior and parents have noticed more self-confidence and enthusiasm for learning. Standardized reading tests show the children participating in the after school program improve reading skills by an average of one grade level. The program has been so successful in raising academic competencies of youth it has caught the attention of the local chapter I program, which will continue to provide funding to sustain and expand these programs when extension funds complete their cycle. (\$117,980) This project will end March 31, 1996. A no-cost extension in 1995-96 was requested and denied.

Science Opportunities Activities and Responsibilities Series (SOARS) which holds Super Science Days at Mississippi State University, where students from that county learn firsthand about science, engineering, and medicine from scientists themselves. Extension staff provide supplemental math and science instruction during the school day. Among the program's goals is to introduce African-American females to a wide range of engineering disciplines. SOARS began in 1992 as a youth-at-risk project designed to increase math and science awareness among the county's fourth through sixth grade students. Partners in the program include the county school system, Extension office, and Project Brickfire, a low-income housing area. Mississippi State University faculty and students provide time and resources to the 265 volunteers serving as tutors and summer camp instructors. Local contributions match the Federal funding two to one.

After the second year, test scores showed 35.8 percent of the students improved in math, 43.7 percent improved in science, and 48.5 percent increased in overall SAT scores. (\$80,000)

The newest of Mississippi's Youth at Risk Program is Project GESTALT (Growth and Education for Students, Teachers, and Advocates Linked Together). Students in the Jackson area public school system are selected to participate in this math and science oriented after school program. Junior and high school students are paired with elementary school students in after school care programs for tutoring and mentoring. The purpose is to enrich learning experiences for younger and older students. Parents receive training in academic support, communication, conflict resolution and are encouraged to participate in career education programs. After 2 year's, Project GESTALT has served over 3,000 students and parents. Project GESTALT is a collaborative effort of the Cooperative Extension Service, Jackson public schools, Mississippi Public Education Forum, the Federal Learn and Serve National and Community Service Program, and six other community civic organizations. (\$222,161)

Title: Expanded Food and Nutrition Education Program

Funding Amount: \$1,694,110.00

Description: The Expanded Food and Nutrition Education Program (EFNEP) has served Mississippi families since 1969 in an effort to influence the food habits and improve the overall health and well being of over one hundred thousand limited resource families. EFNEP is a federally funded program administered by the Extension Service - United States Department of Agriculture and the state land-grant universities and selected county Extension Services.

The fundamental objective of EFNEP is to promote sound nutrition principles among low-income families. Unlike welfare and food assistance programs, EFNEP focuses on nutrition and health related knowledge and skills. Rather than providing food or money to these families EFNEP concentrates on providing them with the tools to use their resources wisely to provide adequate nutrition and to promote good health. Children involved in this program receive activity based learning experiences to educate them in good health and nutrition practices that will enable them to make wise choices themselves and to influence their parents' habits and practices.

Impact In 1995 EFNEP provided informal nutrition education to families with limited resources in 29 Mississippi counties. Ninety-two paraprofessional nutrition educators, under the supervision of professional home economists, teach nutrition related subjects to adult homemakers and youth.

In 1995, 3350 homemakers (84% percent black, 14% white) and a total of 22,459 family members received nutrition education in the adult program through individual home visits or small community based groups. Ninety-one percent of these homemakers completed the graduation requirements for this program. Based on twenty-four hour food recall data, 88% of the graduated homemakers showed a positive change in eating habits as a result of the program. Because this audience has traditionally had diets high in fat, another positive impact has been the reduction of fat consumption of enrolled homemakers. Fewer homemakers also indicated that they were taking supplements at exit from the program. Sixty-four percent of the enrolled homemakers are food stamp recipients. The lessons related to meal planning and food buying have helped families to use their food stamps and other resources wisely, so that they had food at the end of the.

In addition to the adult program, 10,868 pre-school and elementary school children received classroom based nutrition education through the youth EFNEP component in 21 of the 29 counties in cooperation with Head Start agencies and the public schools. These children, in 529 groups, received 4311 contact hours of activity based nutrition and health related education. Their teachers and parents were provided with additional information to reinforce the classroom efforts and to stimulate a better learning environment for the total family.

EFNEP also cooperates and networks with other agencies such as the Mississippi State Department of Health, WIC and Food Stamps to provide more efficient and effective programs to the participants in these programs. A total of 953 volunteers were trained in nutrition related subjects and used to strengthen and expand the outreach of the paraprofessional educators. This volunteer service is valued at over \$11,000.

Title: Southern Rural Development Center

Funding Amount: \$189,290

Description: Established jointly with Mississippi State University and Alcorn State University in 1974, the SRDC is one of four regional centers whose mission is to support the rural development efforts of the Experiment Stations and the Extension Services in 13 Southern states, Puerto Rico and the U.S. Virgin Islands. The Center has a long history of extending knowledge, facilitating collaboration in the region and assisting communities in finding alternatives and opportunities for the future. Current issues identified by the Center's program advisory committee through strategic planning are human capital development, leadership, rural health and poverty.

The mission of the Southern Rural Development Center is to facilitate, foster and initiate regional research and Extension efforts that contribute to an improved quality of life for residents of the Southern region.

Various means are used to address the issues once identified. They are as follows: seed funded projects (multistate, multidisciplinary and/or regional in scope), conferences/seminars for professionals, presentations, regional task forces of professionals addressing specific issues.

Impact: Impacts of specific programs and projects are reported annually. The number and variety of projects and activities can be impressive, but to specifically point out project impacts on two Mississippi efforts, we have attached two information flyers which highlight the following examples:

- Entrepreneurial Development -- a project in Warren and DeSoto counties to teach entrepreneurial, technical and business skills to welfare women.
- Waste Management -- an example of an SRDC-sponsored conference providing training to a participant who returned to her county to form a waste reduction committee which eventually reduced the waste stream and saved significant dollars for the county.

The Center operates with a small staff of 4 FTEs. However, the scope of their efforts reach throughout the region.

Cooperative State Research, Education and Extension Service Annual Funding
 Extension -- \$195,224
 Research -- \$79,504

Title: **Integrated Pest Management**

Funding Amount: \$180,200

Description: Integrated Pest Management (IPM) programs are currently in progress in the following production systems in Mississippi: Cotton, Soybean, Rice, Corn, Wheat, and Greenhouse Tomatoes. Major efforts are targeted toward county agents, producers, consultants and industry personnel.

Greenhouse Tomato IPM Program -- An IPM program developed over the past three seasons by Extension Entomology and Plant Pathology specialists has effectively demonstrated the positive benefits of crop scouting and other IPM strategies to reduce the impact of serious insects and diseases. Growers are learning pest scouting procedures and the scouting report form allows growers to maintain records needed to initiate appropriate IPM procedures in a timely fashion. Yield- and quality-limiting pest problems are handled through the use of resistant varieties, biological, cultural and sanitary IPM techniques as a preventative management strategy. Pesticide applications are based on needs associated with scouting results. This has allowed educational programming to focus on generalized problems for the entire industry and specialized problems for individual growers.

Cotton IPM -- IPM practices are used on essentially 100% of Mississippi's 1.4 million acres of cotton. Cotton insect control recommendations include such IPM tactics as: managing for early crop maturity, use of resistant varieties, use of various cultural practices, insecticide-resistance management, and use of economic thresholds. Scouting is a key component of the cotton IPM program and more than 97% of the acreage is scouted, usually on a twice-weekly basis. This includes acreage scouted by commercial consultants, Extension Service programs, industry fieldmen, and producers. The evolution of insecticide resistance and secondary pests requires intensified efforts in promoting current IPM tactics and in developing new tactics and technologies. Currently available IPM tactics have played a crucial role in maintaining the viability of cotton as one of Mississippi's leading agricultural commodities, despite the problems with insecticide resistance. The importance of IPM in cotton insect management is increasing drastically and developments such as boll weevil eradication and Bt-transgenic cotton will provide enhanced opportunities to use noninsecticidal components of IPM in the future. As this trend toward greater reliance on IPM continues to develop, the level and intensity of training required to implement cotton IPM will also increase.

Impact: Greenhouse Tomatoes --Mississippi is ranked eighth in the United States in greenhouse tomato production. Most of the state's growers follow IPM strategies for disease and insect problems. Such strategies, based on the use of biological, cultural, sanitary, and crop

scouting techniques, allow growers to reduce pest impact on fruit yield and quality. Based on estimated economic benefits of using IPM practices as part of their production programs, growers maintain a 25% yield advantage. This means an extra 5 pounds of fruit per plant --- a net benefit of \$12,500 per 1/4 acre.

Cotton -- Educational efforts are estimated to have contributed approximately \$50 per acre in increased yields and \$40 per acre in reduced control costs. These are conservative estimates that place economic impact of cotton IPM at more than \$125 million for the State.

Title: Pesticide Applicator Training

Funding Amount: \$14,741

Description: Changing trends toward improved water quality, environmental contamination, and preservation of human health established an urgent need for initial and recertification training of pesticide applicators to meet their ever increasing requirements. Additionally, the Worker Protection Standard regulation, has increased the amount of training necessary to workers who are exposed to pesticides. Since its creation in 1970, the Mississippi Pesticide Applicator Training Program has met the educational challenges of this issue with initiation of School IPM, Pesticide Container Recycling Program, Ag Chemical Groundwater Monitoring Program, and Internet accessible information.

Impact: Approximately 4,900 pesticide applicators were trained by Extension in 1995, joining over 20,000 persons who need to be retrained/recertified every three years. The Worker Protection Standard program provided training for approximately 15,000 state workers and pesticide handlers. A total of over 23,000 individual clientele received educational information in the form of workshops, group meetings, computer/video/satellite programs, newsletters, news releases, radio programs, or TV programs.

Pesticide Programs have a direct or indirect linkage with almost all major areas of Extension programming (Food Safety and Quality; Decisions for Health; Family Well Being; Youth At Risk; Plight of Young Children; Expanded Food and Nutrition Education Program; Farm Safety; Decisions for Health; Water Quality and Conservation; Waste Management; Sea Grant, Renewable Resources Extension Act; Sustainable Agriculture Systems; Dislocated Farmer Assistance Grant; Communities in Economic Transition; Pesticide Impact Assessment; and Pest Management).

Title: Pesticide Impact Assessment

Funding Amount: \$24,389

Description: The Mississippi Agricultural Pesticide Impact Assessment Program conducts commodity/pesticide assessments to develop information for a variety of pesticides and important pest problems before regulatory actions are formally proposed. These assessments can assist EPA's required review by providing early regulatory options and risk-reducing strategies.

Questionnaires, surveys and farm visitations are used to defend the use of certain products and prohibit cancellations in some instances. Extension's cooperation with other federal and state agencies leads to broader impacts by successfully designing current agricultural enterprise budgets, by identifying future research needs, by development of containment programs for farmers, and by numerous other contacts/projects.

Impact: Individual contacts made by Extension personnel reached more than 9,000 persons through newsletters, circular letters, e-mail, workshops, meetings, etc. Pesticide assessment has been greatly aided through the development of Extonet, an easily accessible database on Internet. In addition to Extonet, other menu items available include EPA Chemical Substance Fact Sheets, OSHA, and the Worker Protection and Pesticide Poisoning Handbook. This global

information was accessed 3,373 times from more than 534 sites/locations in more than 25 countries.

Title: Farm Safety/AgrAbility

Funding Amount: \$18,735

Description: Farm and rural home safety is a concern nationally as well in Mississippi. Educational programs on farm and rural home safety increase awareness of potential hazards. Cooperative efforts with other agencies broaden the dissemination of prepared educational materials. Educational programs on farm safety include use of radio and television public service announcements, videos, publications, newsletters, news articles, and media interviews. Additional safety information is disseminated in machinery and cotton mechanization presentations.

Impact: Nationally, statistics indicate a 15-20 year trend showing a decline in the number of farm accidents. Farm related deaths are down from 45 to 37 per hundred thousand. Statistical decreases in accidents and deaths are due to improvements in equipment which can in part be attributed to safety programs concerning this equipment.

The Farm Safety Program made 2,511 contacts in 1995. Specific emphasis was made on safety training for cotton module builders. This program was emphasized as a result of two deaths and several injuries attributed to cotton module builders in the mid-south.

Title: Reservation Extension Agent

Funding Amount: \$50,785

Description: Funding supports a fully functioning Extension Service office established on the Choctaw Indian Reservation for the purpose of planning, developing, and implementing youth and adult educational programs unique to the problems facing Choctaw Indians located on the Reservation. The Reservation is home to the Mississippi Band of Choctaw Indians, a federally recognized tribe of nearly 6,000 individuals. The trust land consists of 22,000 acres in a checkerboard pattern located in Neshoba, Kemper, Leake, Scott, Jones, Newton, and Winston Counties.

Impact: The funding for the Reservation Extension Agent is beginning its fourth year. These funds have allowed for the establishing of a fully functioning Extension office. The Agent provides for the distribution of information and delivery of educational programs designed to meet the needs of Reservation personnel and is the link to Mississippi State University, a land-grant university. Youth educational programs addressing issues such as nutrition, teenage pregnancy, drug abuse, importance of the environment and natural resources are carried out through the school system. Learn by doing skills relating to gardening and working in harmony with the environment are taught to youth through hands on projects in outdoor classrooms. Over 500 elementary school children have participated.

In agriculture, a farmer's market has been established with approximately 30 acres set aside for planting and growing fruits and vegetables to support the market and provide fresh vegetables and fruits for family consumption. A new facility has just recently been established with funds generated from grant sources to support the farmer market needs. Each year a field day is held on the Reservation with over 1,000 individuals participating. The field day allows for demonstrations on planting, growing, and marketing techniques, preparation of fresh vegetables and fruits for consumption, and youth activities on the importance of the environment.

A coupon redemption program has been established so fresh vegetables/fruits grown by the Tribe can become a part of diet. Coupons are provided to families and used to purchase fruits and vegetables for family consumption.

The Extension agent has worked closely with tribal leadership and other outside federal, state, and local agencies to ensure a more coordinated effort is carried out in addressing the needs of Reservation personnel. As a result of these efforts, a gardening assistance program was put in place. Free seed/fertilizer, along with tilling and planting services and guidance to those participating are provided. Community-based projects which have resulted in raised bed gardening for elderly individuals who are members of the Choctaw Nursing Home bring youth, adults, and various agencies together. A farmer's market nutrition program with the Tribal WIC (Women, Infants, and Children) has received a \$12,000 grant which makes available fresh produce to young mothers.

In addition to these programs, the Extension office on the Reservation is fully functioning and has access to the Internet System making available educational and research related materials from the Mississippi Cooperative Extension Service and other locations throughout the country to members of the Choctaw Indian Tribe. Regular newsletters and Tribal cable television programs provide information on timely topics relating to youth and adult programming.

Without funding for this project, limited Tribal resources would be available to support programs such as those being carried out by the Reservation Extension Agent. A lack of coordination between federal and state agencies would result in limited and less than needed services. While a county Extension office exists in Neshoba County where the headquarters of the Reservation is, the onsite Extension office provides for a much more organized approach to addressing those unique local needs of Reservation personnel.

Title: Renewable Resources Extension Act

Funding Amount: \$86,190

Description: Renewable Resources Extension Act (RREA) funds support the development of short courses for forest landowners. These short courses provide intensive training in a structured format. A key to the success of these programs has been the linkage between state specialists, area specialists, county agents, and landowner groups. In 1983, RREA provided us the first opportunity to establish this linkage with an area forestry specialist position. RREA has since allowed us to maintain this highly effective statewide forest landowner education program.

Impact: Results of short course evaluation in 1994 indicated that the RREA funds invested have resulted in a ten-fold return in federal tax revenues. In 1995, the value of information received by landowners through 25 county forest land owner short courses was about \$6.3 million. In addition, a series of 15 one-day workshops were used to train 687 landowners in protection and management of 187,386 acres.

Professional natural resource managers were trained through twenty short courses and workshops with the dollar value of information reported to be \$14.5 million. Estimates are that 1.8 million acres of forest land in Mississippi are impacted by these programs in any given year.

Title: Telecommunications and Information Technology

Funding Amount: \$158,880

Description: The Technology Transfer Project is a federally funded project with the primary intent of exploring new technologies for their use and benefit by Extension and other groups within the state. Extension has used the funds to explore new technologies for creating, gathering, and disseminating information and in training others in using the technologies and information gathered through the use of the technologies. These funds have allowed Extension to explore several new technologies for educating and serving the people of Mississippi which would have gone unfunded otherwise. This project has been funded for about 12 years and has funded a wide variety of technologies and projects. Examples

include the GOSSYM-COMAX cotton growth simulation project, the Dietary Analysis Project, local government personnel training, exploring distance learning technologies, and exploring and developing Internet access and utilization.

Impact: Each of the projects explored has directly or indirectly benefitted Mississippi citizens positively. One of the largest, easily measurable benefits is from the GOSSYM-COMAX cotton growth simulation project. The 100 producers in Mississippi using GOSSYM-COMAX have estimated approximately \$45 per acre benefit on the 100,000 acres they farm. This is a \$4,500,000 impact from this project alone.

The Dietary Analysis Project has enabled county Family and Consumer Education professionals to provide nutritional assessment and intervention practices for low-income, high-risk populations. Practically every county professional in Mississippi works with numerous families each year to improve their health through this avenue. This not only positively affects the families involved, it greatly reduces health care costs for county and state governments.

Recently, the project has worked closely with the Rural Health Care Corps, especially in developing and utilizing the interactive videoconferencing system called the Community College Network. This system has allowed widespread dissemination of information in a timely manner and provided a conduit for training that can reach individuals across the state in one session. This has greatly increased the ability to work with personnel from remote portions of the state to design and implement better health care procedures and options.

The Community College Network (CCN) and the Internet are the primary distance learning technologies being explored through the project. The CCN has the advantage of being an interactive system, allowing individuals at wide distances to communicate interactively via the system. Reduced travel, increased number of clientele, and clientele comfort are major benefits of this system. With some clientele, this may be the only way they can be reached. The Internet is the tool of the future. MCES is exploring educational uses of the Internet so that educational programs can be accessed and utilized without ever leaving the home. MCES is exploring possibilities of delivering all of its publications and many programs to the public via the Internet. MCES has a goal of having all of its publications available on the Internet for instantaneous access at any time. The incredible powerful search and retrieval tools available on the Internet allow one to search a world of information on any topic. MCES is attempting to make this world of information available to as many Mississippi citizens as possible.

Educating local government personnel has been a priority of this project since it began. The philosophy is that citizens are better served by a more efficient, effective, and informed government. Every local government in Mississippi is computerized to some extent now and much of the exposure to and impetus behind computerization has come from projects funded by the Technology Transfer project.

The Technology Transfer Project has enabled MCES to explore new technologies with tremendous potential for good. Most of these technologies have been utilized by MCES to improve information creation, gathering, and dissemination techniques. Also, most of these technologies have been transferred to the public as viable tools for many clientele and other public institutions, making them more effective. The lives of practically every citizen in Mississippi has been affected positively in some manner through the efforts of this project.

Title: Rural Health and Safety Education

Funding Amount: \$231,834

Description: The Mississippi Rural Health Corps Project has operated in Mississippi since November 1992, and has evolved into an active influence in Mississippi communities, organizations and families. The three Area Health Agents of Cooperative Extension funded through this project, and supported by the State Health Education Specialist, have facilitated the development of a broad collaborative network of health education services. The major impacts have been to develop several community-based health councils, 16 community rural

health coalitions, and to provide health education on 15 topics to an average of 2,200 people each month.

Impact: In September 1995, a new organization was formed as a result of the collaboration of multiple partners, both organizational and individual, who saw a need for a structured approach to rural health advocacy issues. The Rural Health Corps members at the Health Department and the Cooperative Extension Service, 16 local Coalitions, and the major Health Provider organizations called a meeting to organize a State Rural Health Association for the purpose of combining legislative, educational and support functions of the members. A tremendous response of over 250 initial attendees netted a high energy meeting with ongoing impact. The Rural Health Corps funded the salary for a temporary program assistant position with the support of the the State Office of Rural Health, and the support and office facilities of the Mississippi Rural Development Council to support this effort. Volunteer skilled labor has been recruited to continue the support of the organization as it develops an agenda and a Mississippi Caucus on Rural Health Issues.

During 1995, self-care education contributed to the health and well-being of over 2,300 individuals who participated in Healthwise!Mississippi programs conducted by Area Health Agents, Home Economists, and the Health Specialist. In the first years of Corps activities, self-care program participants were primarily the Cooperative Extension Child Caregivers and Homemakers Volunteers and Area Agency on Aging participants. Since the initial programs, the Corps networks and Extension Agent efforts have expanded the Healthwise audiences to include professional groups; Kellogg grant participants in a large Case Management study; young families of children in daycare, and college students. Additional expanded materials have broadened the appeal of this effort at better health decisions and healthcare cost containment. A study of 25 program participants in Wilkinson County over a six month period revealed that 72% had made a better health decision, 32% had avoided an unnecessary doctors visit, and several reported less anxiety about health issues.

Noxubee County agencies were working independently of each other, and community involvement in problem-solving did not exist. The Rural Health Coalition members have worked diligently to pull together schools, housing complex managers, childcare center personnel and clients, and other community agencies to deal with problems of premature adolescent sexual activity. After two years, the coalition is widely credited with several community-wide events and ongoing educational and collaborative efforts related to these problems.

The Friars Point Rural Health Clinic has provided health education, nursing and medical services throughout the year to an average of 20 community residents each week. The clinic meets the need for preventive and primary care in this community twice each week. The clinic was established when the Rural Health Coalition pooled their resources, organized volunteer labor in the community, and negotiated with county supervisors for the use of an unused building.

Title: Nutrition Education Initiative/Healthy Babies

Funding Amount: \$30,000

Description: Mississippi has one of the highest teen pregnancy rates in the nation and this is especially true of the Mississippi Delta. Teen pregnancy, low birth weight babies, inadequate health care, undernutrition of children, and the school drop-out rate associated with teen pregnancies all contribute to the cycle of poverty in Mississippi.

In an effort to address these problems and have a positive influence on decreasing the teen pregnancy rate, improving the nutrition and health status of the teen mothers and their babies, and providing motivation and encouragement to stay in school, a special project called BABY TALK was initiated in three counties. Bolivar county has a teen pregnancy rate of 61.3; Coahoma, 74.5%; and Tunica county, 54.3%. Statistics for 1993 indicate that 8162 girls, aged 10-19 gave birth. The average infant mortality rate for these counties is 16%.

BABY TALK is a cooperative effort between the Extension Service and WIC and is designed to provide nutrition, health, and parenting education to pregnant and parenting teens (including teen fathers) and to promote the enrollment into WIC early in pregnancy in order to positively influence the outcome of the pregnancy.

Impact: Pregnant and parenting teens in Bolivar, Coahoma, and Tunica counties are recruited into BABY TALK through cooperative efforts with the WIC staff in county health departments and clinics, school counselors, and other social service agencies and groups. A variety of methods are used to reach this hard to reach and hard to motivate audience -classroom teaching in school settings, clinic visits, and home visits.

In addition to teaching the curriculum materials, information will be collected from the participants to show the impact of this project on their pregnancy outcomes and other factors including nutrition and health status, resource management and economic benefits, and social influences.

In working with the participants, the project director has observed improvements in the eating habits of 80% of the teens and support from other family members to provide good nutrition, since many of them live with their mothers or grandmothers. The parenting teens are concerned about the well-being of their babies and all of them are aware of the bonding and nurturing factors of parenting, as well as the physical aspects such as feeding, bathing, and clothing. Breast-feeding promotion has not been very successful, but the teen mothers are very careful in the safe preparation of formula and feeding the baby correctly. One of the major impacts of this program has been the trusting relationship that develops between the teens and the project director. This is a very confusing and complicated time for pregnant and parenting teens and they need someone to depend on for good advice, encouragement, and friendship.

Review of Rural Health Corps in South Mississippi

Until the Rural Health Corps project was augmented, there was a lack of community based promotion regarding health and safety awareness in rural, south Mississippi. There was also an absence of accessible resources to direct users of health services toward appropriate providers. The Rural Health Corps Project has developed through the past three years through the cooperation with its major partners: The Community Colleges, Mississippi State Department of Health, and the Mississippi Cooperative Extension Service along with the association of its private members: Farm Bureau, the State Nursing Association, and the Mississippi Health Care Association. The Coalitions are constantly striving to enhance the quality of health awareness and to augment health provider services in the rural areas of Mississippi.

With the formation of the Rural Health Corps, I was able to coordinate with the five Community Colleges in the lower one-third of the State to form five Coalitions in the counties adjacent to them. Their selection depended upon health care shortages, rural culturally diverse neighborhood of at least 75 persons, and socio-economically diverse in nature. We have been meeting as Coalitions to plan and implement various strategies to address local needs. We have learned that teamwork and joint programming succeeds. The following is a summary of activities which each county coalition has participated in the last three years:

Pearl River County: As a Coalition we have exhibited and performed free health screenings at the Blueberry Festival, the Pearl River Community College Health Fair, the Healthwise for Life Workshop, and the Health Fairs held for the Mississippi Regional Housing Authority and the local elementary school in Poplarville. Numbers suggest impact: at one Health Fair, over 700 residents were screened. The total program value was \$35,756, with a \$201.93 individual savings for a complete set of tests. Many people attending these health fairs have commented that they could not afford to pay for the screenings and would not have been able to have them. The Coalition received a Grant to assist the Christian Care Ministries for the purchase of a van to assist in transportation for the handicapped to medical facilities. The Coalition published a **Healthcare Services Booklet** and wallet size cards listing the available healthcare services in Pearl River County. We also conducted an **Environmental Workshop for Seniors** in which approximately 75 people, including 20 or so children from a local school came and participated in the activities at the Crosby Arboretum in Picayune.

Stone County: Stone County identified the lack of awareness of health resources in the community as an issue. A brochure was written to describe and make citizens aware of services, targeting elderly at health events and youth through the schools. As a Coalition we have been

alert for opportunities for involvement in various creative activities that involved all members: the Stone County Fair, Senior Citizens's Day, the Healthwise for Life Workshop, the receiving of the Grant in which a four-county **Eldercare Workshop** was conducted. We are in the process of negotiating with the Superintendent and Counselors to have the **Values and Choices Curriculum** taught in the Stone County Schools.

Perry County: We wrote a Grant proposal and received \$3,850 to implement the Values and Choices Curriculum, a nation wide abstinence-based sex education program in the county. A county-wide health fair is planned for April, 1996.

Southwest Coalition: Walthall County held hypertension screenings at five locations downtown, reaching over 319 persons and twelve agencies participating, held a **Diabetic Cooking School** in conjunction with the local hospital in Tylertown since diabetes was listed as one of the top five medical concerns in Walthall County. The Coalition published the **Health Care Services Brochures**. We conducted a **Tri-County CAREGIVING Awareness Seminar**. A total of 117 residents of Pike, Amite, and Walthall counties participated in the questions and answer sessions of each of the 20 health agency speakers as well as receiving free screenings.

Hancock County Health Council: We held an "Oktober Fest" for seniors in which approximately 170 Hancock residents received free screenings which included Eye Exams, Cholesterol and Glucose, and Blood Pressure checks. One of the best benefits was the fact that each participant was able to receive their free Flu Immunization. The **Values and Choices Curriculum** is now being taught in the High School to 180 students.

In addition to my work with the Coalitions, I have assisted the county extension staff in twenty-six counties with educational programing. The following is a summary of some of the major topics I have focused on in the past three years:

1. Presented **Healthwise for Life Workshops** in which I have reached a total of 952 elderly participants in a twenty-six county area with a mean age of 70+. The audience included five Catholic Retirement Homes and four Senior Citizen Centers in the Harrison, Hancock, and Jackson county areas. I worked on these workshops in close association with the Southwest Regional office of the AAA (Area Agency on Aging) and the Southern Regional Office of the AAA. Through the many educational workshops and exhibits, I've distributed various health education materials to approximately 2,500 people.
2. I've presented "**HIV/AIDS - Myths versus Fact**" presentations to the following audiences: Faculty/Nursing students of three Community Colleges - Pearl River Community College, Southwest Mississippi Community College, and Mississippi Gulf Coast Community College, Rural Health Initiative Clinics in Perry and Covington Counties, Officer Training Workshops to MHV members in Hancock, Pike, Harrison, Wilkinson, Pearl River Counties, Mississippi Regional Housing Authority #VIII in Poplarville, Mentally Retarded Facilities in Gulfport, Bay St Louis, Picayune, and Waveland.
3. Conducted various **Stress Management Workshops** to the following audiences: Staff Development for teachers in the three schools in Covington County, and in Picayune School District, Student Teacher training at the University of Southern Mississippi (Gulf Park Campus), and Cafeteria Workers in Pearl River and Wilkinson Counties. I taught the Stress Management program for the five county area held in Rankin County. Forty-two officers/members of the MHV participated. I trained ten county Southwest Region Homemaker Volunteers held in Amite County on the same topic in which eighty-three officers/members participated. I presented a Stress Management segment to residents of Pike, Jefferson, Wilkinson, Amite, and Lincoln Counties who were participating in a "Sewing As a Business" Seminar.
4. I presented a "**Living With Diabetes**" program to thirty-seven concerned Wilkinson County residents in July. I presented this program to approximately 15 residents of a Senior Citizen Center in Saucier (Harrison County), and approximately 100 residents from Claiborne and Franklin Counties received training and literature material on "Living with Diabetes" in November, 1995.
5. "**Exercise for Health**" has been presented in Harrison County (Senior Aids Program with the SMPDD) - 42 participated; Rural Health Initiative Clinic in Covington County - 40 participated, Senior Centers in Harrison Counties - 22 participated; Wilkinson County - 10 participated, trained MS Homemaker Volunteers in Wilkinson, Amite, Lawrence, and Lincoln counties to present this program to their club members.
6. "**Alzheimer's Disease**" Workshop was conducted in August in Claiborne County for MHV Leader Training in which 19 people participated. They received handouts and national Support literature from the Alzheimer Association. I have presented this workshop in Harrison County for a local AARP chapter and at the Methodist Retirement Home.

7. **"Immunization"** exhibit and presentation was given in Forrest County at an Elementary School in Petal. The Immunization Representative from the District Office of the MS State Department of Health, Becky Kilgore, and I have presented this presentation to Rotary Clubs in Pearl River, Harrison, and Perry Counties in which approximately 60 members were present. The Rotary Clubs of Mississippi have as their goal to help assist in increasing the number of immunizations in MS. We published an Immunization flyer to be used by members of the Rotary or which can be given out to the public.
8. After extensive research, I discovered the following alarming statistics in three of the counties in the lower Southern region: Of the total of live births in **Pearl River County**, 105 were between the ages of 15 and 19; **Perry County** is ranked 67th out of 82 counties in the number of teen pregnancies (In 1993, 35 births, and four abortions occurred to girls in the 10 to a 19-age bracket); In a survey conducted in the Junior High School in **Stone County**, they found where out of 266 students, 109 students stated that they are sexually active (with the age of the first time experience being: 9 - age 8; 10 - age 9; 22 - age 11; 27 - age 12). In these Counties, I've met with the various School Board members, Superintendents, and Principals to encourage the implementation of the **Values and Choices Curriculum** into their schools. Through the cooperative efforts of the Coalitions, I've met with school counselors and local ministers in these counties in order to inform them of the content of this curriculum. We are striving to gain their support so they can assist us in reaching the parents as well as the students in their counties. We do have the support of the Rural Health Corps Coalitions in each of these counties to teach this curriculum somewhere in these counties, even if the schools denies us access. Pearl River County has received the support of a local organization, PRIDE, to furnish the material in Picayune and the Poplarville Schools are in the process of finding the means to support this curriculum.

REVIEW OF PEARL RIVER HEALTH COALITION

As a Coalition we have made some great strides in accomplishing our major objective: to break down health barriers in Pearl River County. We as a Coalition have ...

- Distributed Health Borchuers, health literature, and performed health screenings at the **Blueberry Jubilee**.
- Distributed information at the **Pearl River Community College Health Fair**.
- Conducted the educational program, **Healthwise for Life Workshop**, in both Picayune and Poplarville.
- Exhibited and performed screenings at the **Mini-Health Fair** held for the Mississippi Regional Housing Authority.
- Received a Grant to assist the **Christian Care Ministries** for the purchase of a van for the handicapped. We have assisted in the publicity and promotion of this van..
- The Coalition published a **Healthcare Services Booklet** and wallet size cards listing the available healthcare services in Pearl River County.
- After extensive research, we discovered the following alarming statistics in Pearl River County: Of the total of live births in Pearl River County, 105 were between the ages of 15 and 19; We have met with many interested groups consisting of School Administrators, Ministers, and Counselors, to encourage the promotion and implementation of the **Values and Choices Curriculum** into the school systems. We

have received the support of a local organization, PRIDE, to furnish the material in Picayune and the Poplarville.

- Conducted a **Culinary Heart Healthy Program** to address the problems of Heart Disease and to educate the general public on the various preventive measures one should incorporate in their life.
- We were well represented by several members of the Pearl County Coalition in the organizational meeting of the Rural Health Association in Jackson in September.
- Conducted an **Environmental Fun Day** held at the Crosby Arboretum in May in which health screenings and educational literature was distributed on health and environmental issues.

REVIEW OF STONE COUNTY COALITION

Stone County has identified resources in the community as an issue. A **Health Services Brochure** has been written to describe and make citizens aware of services, targeting elderly at health events and youth through schools.

Stone County received a Grant for \$1,602.00 - to implement a series of **Caregiver Workshops**, including the development of a resource packet to facilities that have waiting rooms to include this Caregiver material, in the four county area of Hancock, Harrison, Pearl River, and Stone Counties.

The annual **Senior Fair Day** was held in May at the MGCCC Perkinston Campus. There were 35 exhibitors representing a variety of community services and agencies displayed. Three different programs were presented every hour in 30-40 sessions. Ambulances and a scenic tour bus were on display in the parking lot. Health screenings were done throughout the day. Many referrals to physicians were made by the testers.

In a survey conducted in the Junior High School in Stone County, they found where out of 266 students, 109 students stated that they are sexually active (with the age of the first time experience being:

9 - age 8; 10 - age 9; 22 - age 11; 27 - age 12)

The Coalition is working with the School Administration to gain their trust and cooperation in hopes of being allowed to teach the **Values and Choices Curriculum** in their school.

As a Coalition we participated in the **Stone County Fair** in which various Health Agencies conducted health screenings and various members provided health education literature and exhibits.

We were well represented by several members of the Stone County Coalition in the organizational meeting of the **Rural Health Association** in Jackson in September. Our very own Delores Compston was selected as Secretary.

REVIEW OF SOUTHWEST COALITION

Walthall County held **hypertension screenings** at five locations simultaneously with promotion of the Rural Health Corps goals, reaching over 319 persons and twelve agencies participating.

Participated in a **Diabetic Cooking School** in conjunction with the local hospital in Tyllertown since diabetes was listed as one of the top five medical concerns in Walthall County.

A **Health Fair** was scheduled along with the **Healthwise for Life Workshop**.

The Coalition received a grant of \$750.00 to publish the **Health Care Services Brochures** and wallet size cards to inform the residents of a listing of the most appropriate health care information and health services available in Walthall, Amite, and Pike Counties .

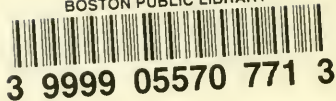
We were well represented by several members of the Southwest Coalition in the organizational meeting of the **Rural Health Association** in Jackson in September.

Members of the Coalition participated in **Summer Fun Day** sponsored by the Alcorn Home Economist, Mrs. Carrie Christian.

Conducted a **Health Concerns Program** in which the members selected key speakers to speak on the topic of Women's Health: Mammography, Menopause, Osteoporosis; and Men's Health: Prostate and Urinary concerns.

Conducted a **Tri-County CAREGIVING Awareness Seminar** in April in order to give the citizens the opportunity to be introduced to and to learn from the various Health Care Agencies available to them. Approximately 20 different Agencies participated in this workshop held April 20 in McComb. Health Screenings, educational literature, and consultations were available to those attending. Ninety-two people elder citizens came and expressed their gratitude for such a program. We gave them the opportunity to express what their major concerns are about Health/Health Care.

We have met with many interested groups consisting of School Administrators, Ministers, and Health Clinics to encourage the promotion and implementation of the **Values and Choices Curriculum** into the school systems or anywhere in the three counties.



CONCLUSION OF HEARING

Senator COCHRAN. Let me conclude by thanking Senator Trent Lott and Congressman Gene Taylor for having representatives from their offices at our hearing today. I appreciate having the opportunity of working with them, members of our State's delegation, in Washington. I also want to thank the members of my staff who have been involved in developing the subject matter of this hearing and also working with the University of Southern Mississippi representatives, Mississippi State representatives in making the arrangements for the hearing. And those who are here at the Gulf Coast Research Laboratory, I want you to know how deeply we appreciate your cooperation at this hearing.

Thank you all for your good cooperation. The hearing is concluded. The subcommittee will recess and reconvene at the call of the Chair.

[Whereupon, at 12:30 p.m., Friday, February 16, the hearing was concluded and the subcommittee was recessed, to reconvene subject to the call of the Chair.]

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